

**ROSEDALE RENOVATION  
PTC 2019-17D  
90 CHAPPLE STREET  
Sault Ste. Marie, Ontario.**

for

Sault Ste. Marie Housing Corporation

Prime Consultant:  
MGP ARCHITECTS ENGINEER INC.  
123 East Street  
Sault Ste. Marie, ON  
P6A 3C7

Project No. **PTC 2019-17D**

October 2019



November 1, 2019

**SUBJECT:                    INVITATION TO TENDER**  
**PTC 2019-17D**  
**ROSEDALE RENOVATION**  
**SAULT STE. MARIE, ONTARIO**

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The *Sault Ste. Marie Housing Corporation (SSMHC)* invites sealed tenders for the **ROSEDALE RENOVATION** at the location listed in the enclosed documents.

In order to be considered, all tenders must be received by the *Sault Ste. Marie Housing Corporation*, 180 Brock Street, Sault Ste. Marie, ON P6A 3B7, no later than **Wednesday November 27, 2019** at **2:00 P.M. LOCAL TIME** at which time the tenders will be publicly opened.

Please complete the tender and other related forms as applicable and return in the envelope provided.

The lowest or any tender will not necessarily be accepted.

Regards,

Jeff Barban,  
Director of Housing Services

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**APPENDIX "A"**

**APPENDIX "B"**

**1. GENERAL DESCRIPTION OF WORK**

- .1 Renovation of existing 1-storey Rosedale Public Elementary School (approximately 31,721 square feet) converted into Group A2 Assembly (Daycare Facilities, Community Hub areas, minor office spaces) and Group C (9 Residential Apartments). Interior demolition has for the most part been completed by Owner, and new roof has been installed.
- .2 The Contractor will be responsible to apply and pay for all required permits for the duration of the project. ***This excludes the Building Permit required by the City of Sault Ste. Marie Building Department.*** A copy of all permits are to be submitted to the Owner prior to commencing work.

**2. SITE LOCATION**

90 CHAPPLE STREET  
Sault Ste. Marie, Ontario

**3. ACCESS TO SITE & INQUIRIES**

- .1 Bidders may obtain access to the site by contacting:

**Liza Chikoski**  
**Infrastructure and Asset Manager,**  
**Sault Ste. Marie Housing Corporation**  
180 Brock Street  
Sault Ste. Marie, ON P6A 3B7  
Telephone: (705) 759-5131 Fax: (705) 759-5212  
[L.Chikoski@socialservices-ssmd.ca](mailto:L.Chikoski@socialservices-ssmd.ca)

- .2 Bidders may address inquiries by email as follows:

**Henry Pietrzakowski**  
**Architect**  
[hpier@mgp-arch-eng.ca](mailto:hpier@mgp-arch-eng.ca)

**MGP ARCHITECTS ENGINEER INC.**  
123 East Street,  
Sault Ste. Marie, ON P6A 3C7

- .3 All inquiries are to be submitted in writing via email no later than **Wednesday November 27 2019 by 2:00 p.m. LOCAL TIME.** Due to funding requirements, **no extensions to closing will be entertained!**
- .4 Clarifications and or revisions will be issued to bidders by Addendum prior to bid closing.

**4. MANDATORY PRE-BID MEETING**

- .1 A mandatory pre-bid briefing meeting will be held for all bidders at:

90 Chapple Street  
Sault Ste. Marie ON

**Wednesday November 13 2019 at 2:00 P.M.**

**Note:** Attendance at the entire meeting is **mandatory** for all bidders.

**5. SCHEDULE OF WORK & COMPLETION DATE**

- .1 Start work upon award of contract and carry out operations **continuously** to ensure completion of all items within of the date of the Contract Order.
- .2 All bidders are to adhere to their stipulated completion date when submitting their tender.

**6. CLOSING DATE - LOCATION**

- .1 In order to be considered, the tender must be received on the forms and in the envelope provided at:

**HOUSING SERVICES  
180 Brock Street  
Sault Ste. Marie, ON P6A 3B7**

**Closing Date: Wednesday November 27, 2019 at 2:00 p.m. LOCAL TIME**

**6. SECURITY**

- .1 Bid Security will be required in accordance with Clause 4.1 of the *Instructions to Bidders*.
- .2 If awarded the contract, Performance Security will be required in accordance with Clause 4.2 of the *Instructions to Bidders*.

**7. BID ACCEPTANCE**

- .1 The lowest or any bid will not necessarily be accepted.
- .2 If the Contractor that is awarded the work cannot complete the work as specified, it is at the sole discretion of the Owner to issue the remainder of the work to the Contractor of its choice.
- .3 The Owner reserves the right to award the Contract in whole or in part.
- .4 Notwithstanding any tender documents that may be made available for

information purposes at other locations, bids will only be accepted on the *Tender Submission Form* submitted in the envelope provided in the tender package duly obtained and registered at the offices of the *Sault Ste. Marie Housing Corporation*.

**END OF SECTION**



## 1. FORM OF CONTRACT

- 1.1 The documents forming the Contract between Owner and Contractor are those contained in Article A3 of the Stipulated Price contract published by the *Canadian Construction Documents Committee (CCDC-2) 2008*.

## 2. TENDER SUBMISSION

- 2.1 The Bidder shall:
- .1 put the bidder's name and return address on the envelope provided for the Tender Submission Form,
  - .2 complete and fully execute the Tender Submission Form supplied and all appendices in all respects with appropriate documents and all requisite information,
- 2.2 The Tender and any amendments thereto **may not** be submitted orally or by telecommunications which include but are not limited to telex, telegram and telephone transmission of facsimiles.
- 2.3 The total amount of the firm, fixed tender price shall be given in writing and numerals. All writing shall be with ink or typewriter except with signature of the bidder which shall be written with ink. Tenders that are incomplete or contain any omission, erasure, alteration, addition, condition, limitation or that show any irregularity may be rejected.
- 2.4 The tender shall be properly signed and the complete address of the bidder shall be given on the tender. If the bidder is a co-partnership, each member shall sign the tender; if a corporation, it shall execute the tender by its duly authorized officers.
- 2.5 The bidder shall include all schedules, and other information specified to enable the Owner to determine the bidder's compliance with the requirements of the Contract Documents. In the event work cannot be completed in accordance with the specified requirements, the bidder shall clearly and explicitly state what the deviations are.
- 2.6 Upon request, a bidder shall verify any information including price contained in his tender, and any tender may be rejected if the Owner is not satisfied with the information furnished.
- 2.7 The submission of a tender proposal shall indicate the acceptance by the bidder of all instructions and conditions contained in the Contract Documents and the tender shall be a firm offer binding the bidder.
- 2.8 Tenders shall not be withdrawn or modified and shall be open for acceptance by the Owner for a period of **thirty (30) days** following the date of receipt of tender proposals. The prices quoted therein shall be **FIRM FIXED PRICES** which shall remain valid and binding on behalf the bidder in the event the tender proposal is accepted by the Owner.

- 2.9 The bidder shall submit tenders on the basis of using the products, materials and methods indicated or specified. Where alternatives are listed, use one only from the list.
- 2.10 Submit with the tender, under material variations, but do not include in the firm fixed tender price, all proposals to substitute other products, materials and methods for those indicated or specified. For each proposed substitution, submit the name of the manufacturer or supplier, the trade name, an explicit description, the amount by which the firm fixed tender price would be changed and all other information necessary for the evaluation of the proposal.
- 2.11 The Owner will determine which, if any, substitutions will be accepted and the Contract price will be adjusted accordingly. The accepted products, material or method will become part of the Contract.
- 2.12 The Owner reserves the right to amend or supplement the Contract Documents at any time prior to the established closing date. Additional information, changes, clarifications or corrections made by the Owner or Consultant on the Owner's behalf to the Contract Documents during the time of bidding shall be issued in the form of addenda which will become part of the Contract and shall be covered in the tender price. The bidder shall acknowledge receipt of these addenda in the space provided in the tender forms.
- 2.13 The bidder is advised that the Owner will not reimburse the bidder for any costs incurred in preparation of a tender proposal.

### 3. SALES TAX

- 3.1 All Provincial Sales and Excise taxes are to be included in the Tender Amount.
- 3.2 The Harmonized Sales Tax (H.S.T.) is to be included with the Total Tender Amount.

### 4. BONDS, BID AND PERFORMANCE SECURITY

#### 4.1 **Bid Security**

- .1 The Bidder shall include together with the Bidder's Tender Submission Form any one of a **Bid Bond** from a Surety acceptable to the Owner, a certified cheque, a Bank Draft or an irrevocable Letter of Credit in favour of the Owner in the amount stipulated in the Tender Submission Form, valid for a period of **thirty (30) days** from the date of tender closing unless otherwise stipulated in the Tender Submission Form.
- .2 Such deposit shall be security to the Owner that the tenderer, if successful, will execute the contract documents and supply the Contract Performance Security in accordance with Section 00200, Clause 4.2.
- .3 Failure to comply with Clause 4.1.2 may result in forfeiture of the Bid Security.
- .4 Bid Security of all tenderers, except the lowest and second lowest tenderers will

be returned within **three (3) business days** of the award of the Contract.

- .5 Bid Security of the two low tenderers will be returned when the Contract has been awarded in accordance with Section 00200, Clause 8.

#### 4.2 Performance Security

- .1 The Contractor shall provide, at the Contractor's costs, **Performance Security** in favour of the Owner in order to secure the due and faithful performance of the Contract, which shall be as follows:
- .1 a Performance Bond issued by a Surety Company acceptable to the Owner's approved form which is attached hereto and shall be in an amount equal to 50% of the Contract Price;
- .2 where the Contract price is less than \$1,000,000.00, but over \$100,000.00, the following alternate forms of security are acceptable in lieu of such Performance Bond:
- (i) an irrevocable letter of credit, bank draft, or certified cheque; or
  - (ii) bearer or negotiable bonds of Canada, the Province of Ontario, or the Ontario Hydro Electric Power Commission (bonds to be assessed at market not face value); or
  - (iii) such other collateral as may be acceptable to the Owner and in each case, the alternate forms of security shall be equivalent to 20% of the Contract Price.
- .3 where the Contract price is less than \$100,000.00, the alternate forms of security listed in 4.2.1.2 (i), (ii), & (iii) shall be equivalent to 10% of the Contract Price.
- .2 If the Contractor fails to meet the requirements of this section within **seven (7) business days** of receipt by the Contractor of the award letter, then the Owner at its sole option may terminate the Contract and use the **Bid Security** toward damages.
- .3 If the Security is in the form of a **Performance Bond**, the document shall be retained by the Owner for a period of two (2) years from the date on which the last payment under the contract falls due, after which it will be returned to the Contractor upon the Contractor's request.
- .4 If alternate security is provided pursuant to this section it will be returned to the Contractor **forty-five (45) days** after completion of the Work and the correction of all deficiencies. If deficiencies involve seasonal work which must be postponed, the security shall be reduced to an amount equal to the value of the work which remains to be completed and the balance of the security returned to

the Contractor **forty-five (45) days** after all other work is completed.

- .5 If required by the Supplementary Conditions, the Contractor shall provide at the Contractor's cost a Labour and Material Payment Bond, acceptable to the Owner's approved form which is attached hereto, and it shall be in an amount equal to 50% of the Contract Price.

## **5. EXAMINATION OF THE SITE AND CONTRACT DOCUMENTS**

- 5.1 Before submitting a Tender the Bidder shall carefully examine the site of the proposed work, evaluate the existing conditions and limitations and include the amounts in the tender to cover the cost of all items required to be done to fulfill the Contract.
- 5.2 The Bidder shall report any discrepancies, errors or omissions to the Owner, the Bidder will be deemed to have accepted all such specifications and drawings as being accurate and the Owner will not approve any extra charges subsequent to acceptance of the Tender.
- 5.3 Questions arising from the bidder's inspection at the site will be answered in addenda where deemed necessary. Existing building information may be available for inspection at the office of the owner. The bidder shall interpret this information according to his own judgment and not rely upon it as accurately descriptive of subsurface conditions which may be found to exist.
- 5.4 Any bidder who is in doubt as to the true meaning or intent of an item in the Contract Documents or who discovers any discrepancies, errors or omissions in the Contract Documents shall notify the owner and request clarification or correction thereof. All such requests shall be in writing or shall be confirmed in writing. No responsibility will be accepted by the Owner for unsupported oral communications or instructions.
- 5.5 The bidder shall ascertain, from the relevant authorities, the availability and existing locations of all services to the project, and without limiting the generality of the foregoing, in particular such services as electric light, power, sewers, water supply, gas, telephone and transportation and availability of roads for traffic, and shall ascertain what prior notice will be required for the installation of the service to the project.

## **6. QUALIFICATION INFORMATION**

- 6.1 The Owner reserves the right to require any Bidder to submit qualification information prior to the award of the Contract which qualification information shall include the

submission of evidence of the capability of the Bidder to carry out and to maintain properly the work and the equipment, together with details of the qualifications of the Bidder's staff that may be employed in the execution of the Contract.

- 6.2 The Owner reserves the right to interpretation of qualification information and any decisions made by the Owner based upon its findings which may affect the award of the Contract shall be final.
- 6.3 The Owner reserves the right to give preference to materials, products and equipment:
- 6.3.1 of Canadian origin and manufacture,
  - 6.3.2 which are environmentally friendly,
  - 6.3.3 which are energy efficient.

## **7. ACCEPTANCE OR REJECTION OF TENDERS**

- 7.1 Under no circumstances will the Owner consider a Tender which is:
- (i) not received at the address given in the Invitation to Tender, within the time prescribed therein;
  - (ii) not properly signed.
- 7.2 The Owner has the unqualified right to:
- (i) accept or reject any Tender or all Tenders; and
  - (ii) waive the formalities in any Tender documents as the interest of the Owner may require, without giving any reasons for any such action.
- 7.3 The Owner is not obliged to accept any Tender because it is the lowest tender submitted.

## **8. AWARD OF CONTRACT**

- 8.1 When a Tender is called for more than one project, a Contract may be awarded on the basis of all or any one or more of the projects, unless otherwise stated in the Invitation to Tender.
- 8.2 The Owner has up to **thirty (30) days** after the date of tender closing to notify the Bidder that his Tender is accepted.
- 8.3 The Contract shall be deemed to be awarded on the date that the Owner advises the Bidder in writing of such award.
- 8.4 If the Bidder alters or withdraws the Bidder's Tender after the date of tender closing or if the Bidder does not provide Insurance or other documents in accordance with the terms of Section 00200 and Section GC11.1 of the General Conditions within the times specified by the Owner, then the Owner may treat the Bidder's Tender and any right of the Bidder to contract or Contract as terminated, and may take such further action as the Owner deems advisable to recover any damages suffered by the Owner

8.5 If there is any discrepancy in the Tender Submission Form or documents submitted by the Bidder, between any amount shown in writing and in figures, the Owner may choose to accept the amount shown in writing or to reject the tender.

8.6 If a contract is awarded, the following documents will all form part of the Contract:

Instruction to Bidders  
Stipulated Price Contract CCDC-2  
Supplementary General Conditions  
Tender Submission Form  
Specifications with Appendices and Addenda  
Drawings  
Schedules  
Award Letter  
Contract Order

## 9. **PRICE BREAKDOWN**

9.1 Immediately upon the opening of tenders the low bidder or bidders will be requested to submit a detailed breakdown (trade by trade) of the cost of the work. The owner will indicate the amount of detail required and the Contractor(s) must present the information promptly.

## 10. **PROOF OF ABILITY**

10.1 The Bidder shall be competent and capable of performing the various items of work.

10.2 The Bidder shall provide, when requested, the firm's latest Workers' Safety Insurance Board Experience Rating and a signed letter which states only competent personnel will be employed on this project in accordance with the Occupational Health and Safety Act - Bill 208.

10.3 The Bidder may be required to furnish names of references conversant with bidder's performance on similar work, names and experience of senior personnel to be used on the work, and such statements of their financial resources as may be found necessary.

10.4 All Contractor's and Subcontractor's employees who work in a Corporate workplace and/or job site are required to have a valid identification card that confirms the worker has attended a "Standardized Safety Orientation Course" administered by the **Sault Safe Community Partnership**, or the *Sault Ste. Marie Construction Association* or an equal Safety Course as determined by the *Sault Ste. Marie Housing Corporation (SSMHC.)*

**END OF SECTION**







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11.1 There is to be no change to the above list without the written consent of the subcontractor concerned or the owner.

12) Appendices must be completed and included with Tender Submission Form.

**SIGNED AND SEALED THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 20 \_\_\_\_\_**

**\*CONTRACTOR:** \_\_\_\_\_

**AUTHORIZED SIGNING OFFICER:** \_\_\_\_\_

**TITLE:** \_\_\_\_\_

**SIGNATURE:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

**CITY:** \_\_\_\_\_ **POSTAL CODE:** \_\_\_\_\_

**TELEPHONE:** \_\_\_\_\_ **FAX:** \_\_\_\_\_

EMAIL: \_\_\_\_\_

WITNESS: \_\_\_\_\_ (Must be witnessed if no seal)

**NOTE:** BIDDERS ARE ADVISED THAT FAILURE TO COMPLETE THIS FORM WILL BE CAUSE FOR DISQUALIFICATION OF THE BID.

**\*Affix Corporate Seal.**

**1. DEFINITIONS**

- .1 The word "**Owner**" means the **SAULT STE. MARIE HOUSING CORPORATION**.
- .2 The word "**Day**" means a calendar day unless otherwise stated.
- .3 The word "**Submittals**" are documents or items required by the Contract Documents to be provided by the Contractor, such as:
  - Shop Drawings, samples, models, mock-ups to indicate details or characteristics, before the portion of the Work that they represent can be incorporated into the Work; and
  - As-built drawings and data books to provide instructions to the operation and maintenance of the Work.

**2. Article GC 10.2 LAWS, NOTICES, PERMITS AND FEES**

- .1 Amend Clause 10.2.2 to read "The Owner shall pay for permanent easements and rights of servitude. The Contractor will be responsible for covering all costs and applying for all permits licenses, or certificates necessary for the performance of the Work which were in force at the date of bid closing with the exception of the Building Permit. Contractor is to provide proof of permits to Owner.

**3. LIABILITY INSURANCE**

- .1 Commercial General Liability insurance shall be with limits of not less than **\$5,000,000** per occurrence, an aggregate limit of not less than **\$5,000,000** within any policy year with respect to completed operations, and a deductible not exceeding \$5,000. The insurance coverage shall not be less than the insurance provided by IBC Form 2100 (including an extension for a standard provincial and territorial form of non-owned automobile liability policy) and IBC Form 2320. To achieve the desired limit, umbrella or excess liability insurance may be used. Subject to satisfactory proof of financial capability by the Contractor, the Owner may agree to increase the deductible amounts.
- .2 Commercial General Liability insurance providing third party bodily and personal injury and property damage coverage in an amount of not less than **\$5,000,000** per occurrence, stating *Sault Ste. Marie Housing Corporation* as an additional insured and containing a Cross Liability and/or Severability of Interest Clause, protecting each insured to the same extent as if they were separately insured.

**4. W.S.I.B.**

- .1 The contractor shall produce a valid W.S.I.B. Certificate of Clearance Form at the commencement of the contract and updated copies as renewed.

**5. APPLICATIONS FOR PROGRESS PAYMENT**

- .1 Add CCDC paragraph 5.2.9 .”The *Contractor* shall submit with each application for payment following the initial application, a statutory declaration signed by a person authorized to sign such a statement. Where the *Contractor* has legal status to sign on his own behalf, his corporate seal must be affixed to the document. The form of such documents shall be in accordance with the latest edition of the CCDC approved Statutory Declaration forms”

**END OF SECTION**

**1. LIST OF DRAWINGS****CIVIL DRAWINGS**

- C1.0 General Notes
- C2.0 Sections and Details
- C3.0 Existing Conditions and Removals
- C4.0 Site Plan and Services
- C5.0 Grading Plan

**ARCHITECTURAL DRAWINGS**

- A0.1 OBC Matrix, Key Plan, General Notes
- A1.1 Fire Separation Plan
- A1.2 Demolition Plan
- A1.3 Site Plan
- A1.4 Wall Assembly Schedule and Fire Access Plan
- A1.5 Playground Details
- A2.1 General Arrangement Plan
- A2.3 Early Start and East Residential Floor Plan
- A2.4 Community Hub Floor Plan and Elevations
- A2.5 West Residential Floor Plan
- A2.6 Discovery Kitchen Enlarged Plan, Elevations and Details
- A2.7 Roof Plan
- A3.1 Reflected Ceiling Plan
- A4.1 Demolition Building Elevations
- A4.2 New Building Elevations
- A5.1 Building Sections
- A5.2 Building and Wall Sections
- A5.3 Wall Sections and Section Details
- A5.4 Wall Section Details
- A5.5 Wall Section and Stair Details
- A7.1 Room Finish Schedule, Door Schedule, Window and Door Types
- A7.2 Millwork Sections and Detail Elevations
- A7.3 Interior Elevations
- A7.4 Interior Elevations
- A7.5 Interior Elevations
- A7.6 Unit Millwork Elevations
- A7.7 Flooring Plan

**STRUCTURAL DRAWINGS**

- S1.0 General Notes
- S2.0 Structural Framing Plan and Details

**MECHANICAL DRAWINGS**

- M0.1 Plumbing Notes, Schedules and Legends
- M0.2 HVAC Notes, Schedules and Legends

|      |  |
|------|--|
| M0.3 | Plumbing Details   |
| M0.4 | Mechanical Details   |
| M0.5 | RTU Units 1,2,3,& 4 Plan & Details   |
| M0.6 | RTU Unit 5, HRV Unit 1, MUA Unit 1 Plan and Details                                  |
| M0.7 | Unit Furnaces Plan and Details   |
| M0.8 | Kitchen MUA Unit, Exhaust Hood & Fan, Schedules and Details                          |
| M1.0 | Main Floor Sanitary & Drainage Deconstruction Plan                                   |
| M1.1 | Main Floor Sanitary & Drainage Piping Plan   |
| M2.0 | Main Floor Domestic Water (DCW/DHW) Deconstruction Plan                              |
| M2.1 | Main Floor Domestic Water (DCW/DHW) Piping Plan                                      |
| M3.0 | Main Floor HVAC Ductwork Plan  |
| M4.0 | One Bedroom Units, Types A1, A, B, C, & D, Algoma Family Services HVAC Ductwork Plan |
| M4.1 | 1 Bedroom Type E, 2 Bedroom Units Type A & B HVAC Ductwork Plans                     |
| M4.2 | West Wing HVAC Ductwork Plan   |
| M4.3 | Daycare HVAC Ductwork Plan   |
| M4.4 | Early Start HVAC Ductwork Plan   |
| M5.0 | Roof Natural Gas Piping Plan   |
| M5.1 | Mechanical Sections 1  |
| M5.2 | Mechanical Sections 2  |
| M6.1 | Main Floor Operations Fire Protection Plan   |
| M7.0 | Control Diagrams 1   |
| M7.1 | Control Diagrams 2   |

**ELECTRICAL DRAWINGS**

|      |   |
|------|---|
| E0.1 | Electrical Notes, Schedules and Legends   |
| E0.2 | Electrical Site Services Plan, Notes and Electrical Design Load Calculations        |
| E0.3 | Electrical Single Line Riser Diagram  |
| E0.4 | Electrical Site Details and Notes   |
| E0.5 | Electrical Details and Notes  |
| E0.6 | Panel Schedules, Electrical Details and Notes                                       |
| E0.7 | Site Lighting Photometry, CCTV Riser Diagram and Details                            |
| E1.1 | Ground Floor Power/Telecommunication Plan   |
| E1.2 | Ground Floor Apt's 301/304/305/306/307 & AFS 212 Power/Telecommunication/FA Plans   |
| E1.3 | Ground Floor APT'S 401/402/405 & 406 Power/Telecommunication/FA Plans               |
| E1.4 | Ground Floor Partial West Wing Power/Telecommunication/FA Plan                      |
| E1.5 | Ground Floor Daycare Power/Telecommunication/FA Plan                                |
| E1.6 | Ground Floor Early Start Power/Telecommunication/FA and Elec Rm 209/IT Rm 210 Plans |
| E2.1 | Ground Floor Lighting Plan  |
| E2.2 | Ground Floor APT'S 301/304/305/306/307 & AFS 212 Lighting Plan                      |
| E2.3 | Ground Floor APT'S 401/402/405 & 406 Lighting Plan                                  |
| E2.4 | Partial Ground Floor West Wing Lighting Plans                                       |
| E2.5 | Partial Ground Floor Daycare Lighting Plan  |
| E2.6 | Partial Ground Floor Early Start Lighting Plan                                      |
| E3.1 | Ground Floor Fire Alarm Zoning Plan, Schedule and Fire Alarm Riser Diagram          |
| E4.1 | Ground Floor CCTV Camera Plan   |

END OF SECTION

**APPENDIX "A"**

Proponents who have not undertaken work of this nature with this office in the past two years are required to complete Appendix "A" giving a brief description of their company and a list of recently completed projects of this nature complete with references from Owners or Consultants involved in the installations.

Tender Award will be made on the basis of verified acceptable references, completed projects, and tender price, notwithstanding the owner's right to reject any of or the entire submitted tender.

**COMPANY NAME:** \_\_\_\_\_

**BRIEF DESCRIPTION:**

---

**PROJECT:**  
(Include Location & Date Completed)

**REFERENCES:**

**OWNER OR CONSULTANT**  
(Include Name & Address)



**APPENDIX "B"****1. MATERIAL VARIATIONS**

1.1 Note that this is a base bid specification. Materials or articles specified by brand name or catalogue number and/or by the name of the manufacturer or supplier will form the basis of the Contract.

1.2 Propose any substitutions for materials or equipment under the following conditions:

(a) Base the Contract Price on the materials and equipment specified.

(b) List all proposed alternates in the appropriate section of the Bid Form, showing the product name and stating what difference, if any, would be made in the amount of the Contract Price for each alternate should it be accepted.

Any or all such alternates may be accepted or rejected by the Owner. In the event of acceptance the Contract Price will be changed accordingly.

**2. ALTERNATE PRICES**

.1 Insert in the spaces provided on the Bid Form, alternate prices, if any, for all proposed substitutions.

.2 The alternate prices included on the Bid Form shall NOT be included in the Stipulated Price.

I/We propose the following alternate products in lieu of those specified and agree that if any are accepted by the Owner the Bid stated in Article 1 of this Bid Form will be modified as indicated. If there is no change in the Stipulated Price, I/we have so indicated. All alternate prices exclude Harmonized Sales Tax. I/We list herewith a description of each proposed alternate and cost effect on the Stipulated Price:

| Section | Product Specified | Proposed Alternate | Add To Stipulated Price | Deduct From Stipulated Price |
|---------|-------------------|--------------------|-------------------------|------------------------------|
|         |                   |                    |                         |                              |
|         |                   |                    |                         |                              |
|         |                   |                    |                         |                              |
|         |                   |                    |                         |                              |
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|         |                   |                    |                         |                              |
|         |                   |                    |                         |                              |
|         |                   |                    |                         |                              |
|         |                   |                    |                         |                              |

I/We acknowledge that the Owner may accept or reject any or all proposed alternates. I/We understand that alternate prices will be considered in determining the lowest Bidder. I/We understand that acceptance of any alternates will not affect the completion time of the project, unless I/we have specifically indicate an increase or decrease in time.

## **SECTION 01005 - GENERAL REQUIREMENTS**

---

### **1. GENERAL REQUIREMENTS**

- .1 Division 1 requirements apply to all Sections of Work.

### **2. SUMMARY OF WORK**

- .1 Provide all items, articles, materials, services and incidentals, whether or not expressly specified or shown on Drawings, to make finished work complete and fully operational, consistent with the intent of the Contract Documents.
- .2 Provide all work indicated in Contract Documents, regardless whether located within or outside Owner's property lines.
- .3 The following work is not included in this Contract:
  - .1 Work designated N.I.C.

### **3. DIVISION OF WORK**

- .1 Work specified in the Specification has been divided into technical Sections for the purpose of ready reference. Division of work among Subcontractors and suppliers is solely the Contractor's responsibility and Consultant assumes no responsibility to act as an arbiter to establish subcontract limits between Sections or Divisions of work.

### **4. SAFETY AND SECURITY**

- .1 Be responsible for security of all areas affected by work of this Contract until taken over by Owner. Take steps to prevent entry to the Work by unauthorized persons and guard against theft, fire and damage by any cause.
- .2 Provide suitable surveillance equipment and/or employ guard services, as required to adequately protect the Work.
- .3 Maintain fire protection for work. Store paints and volatile substances in a separate and controlled location and inspect frequently. Inspect temporary wiring, drop cords, extension cables for defective insulation or connections frequently. Remove combustible wastes frequently. Prohibit smoking in areas where volatile and flammable substances are used.
- .4 Do not cut, bore or sleeve through any loadbearing member, new or existing without Consultant's written authorization, unless specifically indicated on Drawings.

### **5. USE OF SITE**

- .1 Accept full responsibility for assigned work areas from the time of Contract award until Substantial Performance of the Work.
- .2 Check means of access and egress, rights and interests which may be interfered with. Do not block lanes, roadways, entrances or exits. Direct construction traffic and locate access to site as directed by municipality.
- .3 Where encroachment beyond property limits is necessary make arrangement with respective property owners.

**END**

## SECTION 01090 - ABBREVIATIONS

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1. The abbreviations listed below, when used in the Contract Documents, shall have the meanings shown.
2. See Drawing Abbreviations and Room Finish Schedule for additional abbreviations.

### ABBREVIATION MEANING

|        |  |
|--------|--|
| AA     | ALUMINUM ASSOCIATION   |
| AAMA   | ARCHITECTURAL ALUMINUM MANUFACTURERS' ASSOCIATION                        |
| AASHTO | AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS                          |
| ACI    | AMERICAN CONCRETE INSTITUTE  |
| AGA    | AMERICAN GAS ASSOCIATION   |
| AIA    | AMERICAN INSTITUTE OF ARCHITECTS   |
| AIMA   | ACOUSTICAL & INSULATING MATERIALS ASSOCIATION                            |
| AISC   | AMERICAN INSTITUTE OF STEEL CONSTRUCTION                                 |
| AISI   | AMERICAN IRON AND STEEL INSTITUTE  |
| AMCA   | AIR MOVING AND CONDITIONING ASSOCIATION INC.                             |
| ANSI   | AMERICAN NATIONAL STANDARDS INSTITUTE                                    |
| ASHRAE | AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIRCONDITIONING ENGINEERS |
| ASTM   | AMERICAN SOCIETY FOR TESTING AND MATERIALS                               |
| AWI    | ARCHITECTURAL WOODWORK INSTITUTE (USA)                                   |
| AWMAC  | ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA               |
| AWS    | AMERICAN WELDING SOCIETY   |
| CCA    | CANADIAN CONSTRUCTION ASSOCIATION  |
| CCRC   | CANADIAN CODE FOR RESIDENTIAL CONSTRUCTION                               |
| CEC    | CANADIAN ELECTRICAL CODE   |
| CFUA   | CANADIAN FIRE UNDERWRITERS ASSOCIATION                                   |
| CGA    | CANADIAN GAS ASSOCIATION   |
| CGSB   | CANADIAN GENERAL STANDARDS BOARD   |
| CIQS   | CANADIAN INSTITUTE OF QUANTITY SURVEYORS                                 |
| CISC   | CANADIAN INSTITUTE OF STEEL CONSTRUCTION                                 |
| CITC   | CANADIAN INSTITUTE OF TIMBER CONSTRUCTION                                |
| CLA    | CANADIAN LUMBERMEN'S ASSOCIATION   |
| CMHC   | CANADA MORTGAGE & HOUSING CORPORATION                                    |
| COFI   | COUNCIL OF FOREST INDUSTRIES OF BRITISH COLUMBIA                         |
| CPCI   | CANADIAN PRESTRESSED CONCRETE INSTITUTE                                  |
| CRCA   | CANADIAN ROOFING CONTRACTORS ASSOCIATION                                 |
| CSA    | CANADIAN STANDARDS ASSOCIATION   |
| CSC    | CONSTRUCTION SPECIFICATIONS CANADA                                       |
| CSI    | CONSTRUCTION SPECIFICATIONS INSTITUTE (USA)                              |
| CSPI   | CORRUGATED STEEL PIPE INSTITUTE  |
| CSSBI  | CANADIAN SHEET STEEL BUILDING INSTITUTE                                  |
| CUA    | CANADIAN UNDERWRITERS' ASSOCIATION                                       |
| CWB    | CANADIAN WELDING BUREAU  |
| CWC    | CANADIAN WOOD COUNCIL  |
| DND    | DEPARTMENT OF NATIONAL DEFENCE, CANADA                                   |
| FM     | FACTORY MUTUAL ENGINEERING CORPORATION                                   |
| FS     | FEDERAL SPECIFICATION (USA)  |
| IES    | ILLUMINATING ENGINEERING SOCIETY   |
| IGMAC  | INSULATED GLASS MANUFACTURERS ASSOCIATION OF CANADA                      |
| LTIC   | LAMINATED TIMBER INSTITUTE OF CANADA                                     |
| MIA    | MARBLE INSTITUTE OF AMERICA  |
| MPMDD  | MODIFIED PROCTOR MAXIMUM DRY DENSITY                                     |
| NAAMM  | NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (USA)          |
| NBFU   | NATIONAL BOARD OF FIRE UNDERWRITERS                                      |
| NBC    | NATIONAL BUILDING CODE OF CANADA   |
| NBS    | NATIONAL BUREAU OF STANDARDS (USDC)                                      |
| NEMA   | NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION                           |
| NFPA   | NATIONAL FIRE PROTECTION ASSOCIATION                                     |
| NHLA   | NATIONAL HARDWOOD LUMBER ASSOCIATION (USA)                               |
| NLGA   | NATIONAL LUMBER GRADES AUTHORITY   |
| NRC    | NATIONAL RESEARCH COUNCIL  |

## **SECTION 01090 - ABBREVIATIONS**

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### **ABBREVIATION MEANING**

|        |   |
|--------|---|
| OBC    | ONTARIO BUILDING CODE   |
| OHSA   | OCCUPATIONAL HEALTH AND SAFETY ACT                                |
| OPSS   | ONTARIO PROVINCIAL STANDARD SPECIFICATIONS                        |
| PCA    | PORTLAND CEMENT ASSOCIATION                                       |
| PCI    | PRESTRESSED CONCRETE INSTITUTE                                    |
| RAIC   | ROYAL ARCHITECTURAL INSTITUTE OF CANADA                           |
| SDI    | STEEL DECK INSTITUTE  |
| SMACNA | SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION |
| SPMDD  | STANDARD PROCTOR MAXIMUM DRY DENSITY                              |
| SSPC   | STEEL STRUCTURES PAINTING COUNCIL                                 |
| TTMAC  | TERRAZZO, TILE & MARBLE ASSOCIATION OF CANADA                     |
| ULC    | UNDERWRITERS' LABORATORIES OF CANADA                              |
| ULI    | UNDERWRITERS' LABORATORIES, INC. (USA)                            |
| USAS   | UNITED STATES OF AMERICA STANDARDS INSTITUTE                      |
| WSIB   | WORKPLACE SAFETY AND INSURANCE BOARD                              |

**END**

## SECTION 01210 - ALLOWANCES

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### 1. GENERAL

- .1 Comply with GC 4.1 CASH ALLOWANCES and GC 4.2 CONTINGENCY ALLOWANCE.
- .2 Cash allowances are designated for additional work and services deemed to be necessary by Owner, from time to time, throughout the execution of the Work. Where a cash allowance refers to an item or category of work already included in Contract Documents, it shall be assumed to cover work or services in addition to that indicated, unless specifically indicated otherwise.
- .3 Contractor may be required from time to time to assist in tendering of certain items of work covered by allowance, as directed by Consultant.

### 2. AUTHORIZATION

- .1 Expenditures from allowances included in the Contract must be authorized in writing by the Consultant.
- .2 Work covered by allowances shall be performed for such amounts and by such persons as directed by the Consultant.

### 3. CASH ALLOWANCES

- .1 Cash allowances include supply and installation unless specifically indicated otherwise.
- .2 Supply only allowances shall include:
  - .1 Net cost of products
  - .2 Delivery to site
  - .3 Applicable taxes and duties (excluding HST)
- .3 Supply and install allowances shall include:
  - .1 Net cost of products
  - .2 Delivery to site
  - .3 Unloading, storing, handling of products on site
  - .4 Installation, finishing and commissioning of products
  - .5 Applicable taxes and duties (excluding HST)
- .4 Inspection and testing allowances shall include:
  - .1 Net costs of inspection / testing services
  - .2 Applicable taxes (excluding HST)
- .5 Other costs related to work covered by cash allowances are not covered by the allowance but shall be included separately in Contract.
- .6 Include in the Contract a cash allowance in the amount of **\$195,000.00 (One Hundred Ninety Five Thousand) for the following:**
  - .1 PVC Roofing, RTU curb and vent flashing, paving stone \$70,000.00
  - .2 ACM Abatement \$10,000.00
  - .3 Third Party Compaction Testing \$5,000.00
  - .4 Controls \$75,000.00
  - .5 Gym Sound System \$10,000.00
  - .6 PUC Electrical \$25,000.00

END

## **SECTION 01310 - PROJECT COORDINATION**

---

### **1. PRE-CONSTRUCTION MEETING**

- .1 Immediately prior to construction, upon notification attend at location of Owner's choice, pre-construction meeting, along with authoritative representatives of certain key subcontractors as specifically indicated in the conference notice.
- .2 Purpose of meeting is as follows:
  - .1 Review project communications procedures.
  - .2 Review contract administration requirements including submittals, payment and change order procedures.
  - .3 Identify all critical points on construction schedule for positive action.
  - .4 Identify any product availability problems and substitution requests.
  - .5 Establish site arrangements and temporary facilities.
  - .6 Review Consultant's inspection requirements.
  - .7 Review any points which, in Owner's, Consultant's and Contractor's opinion, require clarification.
- .3 The Consultant shall organize and chair the pre-construction meeting. Consultant shall record minutes of pre-construction meeting and distribute a copy to each participant within ten days of meeting.

### **2. SITE MEETINGS**

- .1 Prior to the commencement of the Work, the Contractor together with the Consultant shall mutually agree to a sequence for holding regular site meetings.
- .2 Organize and chair site meetings. Ensure that persons, whose presence is required, are present and that relative information is available to allow meetings to be conducted efficiently.
- .3 Once a month or more often if directed by Consultant include review with Consultant and Owner of construction schedule and application for progress payment, during or immediately following site meeting.
- .4 Record minutes of each meeting and promptly distribute copies to be received by all participants not later than seven days after meeting has been held. Distribute minutes of meetings to all Consultants, whether in attendance or not.

### **3. SUPERVISION**

- .1 Employ an experienced and qualified supervisor who shall be in complete charge of the Work from commencement to final completion of the Work and who shall be present at the site whenever work is being carried out. A working foreperson will not be acceptable. The supervisor shall not be changed after commencement of work without the Consultant's approval.
- .2 Supervise, direct, manage and control the work of all forces carrying out the Work, including subcontractors and suppliers. Carry out daily inspections to ensure compliance with the Contract Documents and the maintenance of quality standards. Ensure that the supervisory staff includes personnel competent in supervising all Sections of Work required.
- .3 Arrange for sufficient number of qualified assistants to the supervisor as required for the proper and efficient execution of the Work.

## **SECTION 01310 - PROJECT COORDINATION**

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### **4. DOCUMENTS ON SITE**

- .1 Contractor's field office shall at all times contain a complete set of Contract Documents (Drawings and Specifications) with all addenda, site instructions, change orders, reviewed shop drawings and samples, colour schedule, paint materials schedules, hardware list, progress reports and meeting minutes.

### **5. INTERFERENCE AND COORDINATION DRAWINGS**

- .1 Prepare interference and equipment placing drawings to ensure that all components will be properly accommodated within the spaces provided.
- .2 Prepare drawings to indicate coordination and methods of installation of a system with other systems where their relationship is critical. Ensure that all details of equipment apparatus, and connections are coordinated.
- .3 Ensure that clearances required by jurisdictional authorities and clearances for proper maintenance are indicated on drawings.
- .4 Upon Consultant's request submit copies of interference drawings to Consultant.

### **6. SLEEVING AND INSERT SETTING DRAWINGS**

- .1 Prepare sleeving drawings for work of Division 15 and 16, showing size and location of all penetrations through load bearing elements. Submit sleeving drawings to Consultant for review not less than 15 days prior to construction of affected elements.
- .2 Prepare insert setting drawings for work to be cast into concrete and / or mortared into masonry elements. Submit insert setting drawings to Consultant for review not less than 15 days prior to construction of affected elements.

**END**



## **SECTION 01320 - PROJECT PROGRESS DOCUMENTATION**

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### **1. CONSTRUCTION SCHEDULE**

- .1 Within 14 days of Contract award, submit in format acceptable to Consultant, minimum 6 copies of Contractor's critical path construction schedule.
- .2 Provide computer generated Schedule using suitable scheduling, software such as Gantt or Microsoft Project.
- .3 Set up format to permit plotting of actual construction progress against scheduled progress.
- .4 Schedule shall show:
  - .1 Commencement and completion dates of Contract.
  - .2 Commencement and completion dates of construction stages/phases, if any.
  - .3 Commencement and completion dates of each trade. Major trades shall be further broken down as directed by Consultant; generally follow Specification format.
  - .4 Order and delivery dates for major or critical equipment.
  - .5 Critical dates for shop drawing/sample submissions.
  - .6 Any other information relating to orderly progress of Contract, considered by Contractor or Consultant to be pertinent.
- .5 Consultant, together with Contractor shall review construction progress once a month during or immediately following regular site meeting, or more often as directed by Consultant.
- .6 Update construction schedule, whenever changes occur, in manner and at times acceptable to Consultant.
- .7 Plot actual construction progress or schedule at least once a week.
- .8 Submit copy of updated schedule to Consultant once a month, concurrently with application for payment.

### **2. CASH FLOW CHART**

- .1 Within 7 days after award of Contract, submit, in form approved by Consultant, cash flow chart broken down on a monthly basis in an approved manner. Cash flow chart shall indicate anticipated Contractor's monthly progress billings from commencement of work until completion.
- .2 Update cash flow chart whenever changes occur to scheduling and in manner and at times satisfactory to Consultant.

### **3. PROGRESS RECORD**

- .1 Maintain on site, permanent written record of progress of work. Record shall be open to inspection by Consultant at all times and copy shall be furnished to Consultant upon request.
- .2 This record shall show weather conditions, dates of commencement, progress and completion of various trades and items of work. Particulars pertaining to erection and removal of forms, pouring of concrete, installation of roofing and other critical or major components as well as number of employees of various trades and type and quantity of equipment employed daily, shall be noted.
- .3 Display a copy of the construction schedule in the site office from start of construction to completion. Superimpose actual progress of work on schedule at least once each week.

## **SECTION 01320 - PROJECT PROGRESS DOCUMENTATION**

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### **4. RECORD DRAWINGS**

- .1 Obtain and keep on site at all times a complete and separate set of black line white prints.
- .2 Note clearly, neatly, accurately and promptly as the work progresses all architectural, structural mechanical and electrical changes, revisions and additions to the work and deviations from the Contract Documents.
- .3 Accurate location, depth, position, size and type of concealed and underground services, both inside and outside shall be included as part of these record drawings.
- .4 Record drawings shall be available for review at each site meeting.
- .5 Refer to Section 01770 for requirements on submission of record drawings.

### **5. PROGRESS PHOTOGRAPHS**

- .1 Concurrently with monthly application for payment submit two sets of four 200 mm x 250 mm coloured, glossy photographs or digital files in jpeg format as follows:
  1. Up to four photographs shall be taken from positions determined by Consultant.
  2. Photographs shall be properly exposed and in focus; views shall be unobstructed.
  3. Identify each photograph stating name of project, name of photographer, description of view and date of photograph taken.

### **6. CERTIFIED SITE PLAN**

- .1 Upon completion of foundation work, submit four copies of a survey of the final disposition of the building from a qualified Ontario Land Surveyor certifying that all parts of the building are located in accordance with the requirements of the Contract Documents.
- .2 The surveyor shall verify and certify additional lines and levels of any part of the work if deemed necessary by the Consultant. Deviations from Drawings shall be reported to the Consultant in writing within 24 hours of detection.
- .3 On completion of the work and before application for Substantial Performance, submit to the Consultant six copies of the same survey submitted after completion of foundation work but supplemented by the same surveyor to show outline of paved areas, final finished grades throughout site and location of buried services. Any deviations from Contract Documents shall be noted.

### **7. PRODUCT DELIVERY CONTROL**

- .1 It is the responsibility of the Contractor to ensure that the supplier or distributor of materials specified or alternatives accepted, which he intends to use, has materials on the site when required. The Contractor shall obtain confirmed delivery dates from the supplier.
- .2 Provide equipment delivery schedule, coordinated with construction and submittals' schedule, showing delivery dates for major and/or critical equipment.
- .3 The Contractor shall contact the Consultant immediately upon receipt of information indicating that any material or item, will not be available on time, in accordance with the original schedule, and similarly it shall be the responsibility of all subcontractors and suppliers to so inform the Contractor.
- .4 The Consultant reserves the right to receive from the Contractor at any time, upon request, copies of actual purchase or work orders of any material or products to be supplied for the work.
- .5 If materials and products have not been placed on order, the Consultant may instruct such items to be placed on order, if direct communication in writing from the manufacturer or prime suppliers is not available indicating that delivery of said material will be made in sufficient time for the orderly completion of the Work.

## **SECTION 01320 - PROJECT PROGRESS DOCUMENTATION**

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- .6 The Consultant's review of purchase orders or other related documentation shall in no way release the Contractor, or his subcontractors and suppliers from their responsibility for ensuring the timely ordering of all materials and items required, including the necessary expediting, to complete the work as scheduled in accordance with the Contract Documents.

**END**

## SECTION 01330 - SUBMITTALS

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### 1. GENERAL

- .1 Unless specified or directed otherwise, make all submissions to the Consultant at his office.
- .2 Make all submissions required by the Contract Documents with reasonable promptness and in orderly sequence so as to cause no delay in the work.

### 2. RELATED REQUIREMENTS

- .1 Make the following submissions in accordance with requirements specified elsewhere:
  - .1 Applications for payment: GC 5.2
  - .2 Insurance certificates: GC 11.1
  - .3 Bonds: GC 11.2
  - .4 Construction schedule: Section 01320
  - .5 Cash flow chart: Section 01320
  - .6 Progress photographs: Section 01320
  - .7 Equipment delivery schedule: Section 01320
  - .8 Purchase order documentation: Section 01320
  - .9 Certified site plan: Section 01320
  - .10 Waste audit and reduction plans: Section 01410
  - .11 Maintenance and operations data: Section 01770
  - .12 Record drawings: Section 01770
  - .13 Maintenance materials: Section 01770

### 3. SCHEDULE OF VALUES

- .1 Submit schedule of values in accordance with requirements of GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT.
- .2 Follow specifications table of contents as basis for degree of breakdown required. Show breakdown for different construction phases/stages if required by Consultant.
- .3 Break down cost for large items of work as directed by Consultant.
- .4 Provide additional cost breakdown information if requested by Consultant.

### 4. SCHEDULE OF SUBMITTALS

- .1 Within 15 days of submission of construction schedule submit a schedule of submittals for shop drawings, samples, lists of materials and other documentation requiring Consultant's review.
- .2 For each item requiring submission and review show anticipated date of submission and critical date for return of reviewed submission.
- .3 Design sequence of submissions to reflect requirements of construction schedule.
- .4 Allow up to 15 days for Consultant's review for each submission. Stagger submissions as much as possible to permit adequate review time for each item submitted. If several submissions are made at the same time or within a short time of each other, indicate order of priority in which submissions should be reviewed.

## **SECTION 01330 - SUBMITTALS**

---

- .5 Include sufficient time to permit corrections and resubmission, if necessary, without affecting construction schedule.

### **5. SHOP DRAWINGS**

- .1 Submit shop drawings required by Contract Documents, in accordance with requirements of GC 3.11 SHOP DRAWINGS.
- .2 Prepare shop drawings in metric measurements only. Shop drawings containing imperial measurements will be rejected.
- .3 Unless otherwise directed by the Consultant, submit the following number of prints for each shop drawing required:
  - .1 Architectural shop drawings: 4 prints
  - .2 Structural, mechanical, electrical shop drawings: 5 prints
- .4 After review Consultant shall return a marked-up print to the Contractor. Contractor shall obtain and distribute the necessary number of copies for each shop drawing.
- .5 Shop drawings which require the approval of a legally constituted authority having jurisdiction shall be submitted by Contractor to such authority for approval. Such shop drawings shall receive final approval of authority having jurisdiction before Consultant's final review.
- .6 No work requiring a shop drawing submission shall be commenced until the submission has received Consultant's final review. Do not use any shop drawing, erection drawing or setting drawing which does not bear the stamp and signature of the Consultant.
- .7 The Consultant's review is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and this review shall not relieve the Contractor of his responsibility for meeting the requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

### **6. SAMPLES**

- .1 Submit samples required by Contract Documents and as directed by the Consultant.
- .2 Unless indicated otherwise submit samples in duplicate.
- .3 Where colour selection is required submit manufacturer's full colour range for specified product line.
- .4 Submit samples with identifying labels bearing material or component description, manufacturer's name and brand name, Contractor's name, project name, location in which material or component is to be used, and date.
- .5 Prepay any shipping charges involved for delivering samples to destination point and returning to point of origin if required.
- .6 No work requiring a sample submission shall be commenced until the submission has received Consultant's final review.

### **7. DIGITAL DRAWINGS**

- .1 Contractor shall, under the following conditions, obtain from Consultant electronic PDF files (called hereinafter the "Files") of contract drawings for the purpose of preparing record drawings and, where specifically permitted by Consultant, for the preparation of shop drawings.

## **SECTION 01330 - SUBMITTALS**

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- .1 Purchase a complete set of CAD Files of all contract drawings, including sub-consultants' drawings, for the following amounts, not including HST:
- .1 Architectural, Site Services and Landscaping: \$1,000.00
  - .2 Structural: \$500.00
  - .3 Mechanical: \$750.00
  - .4 Electrical: \$750.00
- .2 The requested Files complete with all data, internal file structure shall be kept confidential and shall remain the property of the Consultant and or his sub-consultants, including all copyrights applying thereto.
- .3 There is no warranty, expressed or implied, that the use of the Files will meet the intended purpose of the Contractor receiving the Files or that the files represent or reflect the complete scope of work.
- .4 The Contractor receiving the Files shall indemnify and hold the consultant harmless from any claims or damages arising from the use of the Files.
- .5 In the event that drawing files transferred contain Consultant title block, permits or professional seals, the Files shall be immediately returned to Consultant and all copies thereof destroyed.
- .6 No use shall be made of the Files for any purpose other than the one stated above.

**END**

## **SECTION 01410 - REGULATORY REQUIREMENTS**

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### **1. PERMITS, LICENCES, FEES**

- .1 Comply with requirements of GC 10.2.
- .2 Where permits, licences and inspection fees are required by authorities having jurisdiction for specific trade functions, they shall be obtained by particular subtrade responsible for that work.
- .3 Review building permit set with Consultant immediately following receipt of building permit and jointly determine whether or not changes to Contract are required.
- .4 Be responsible for ensuring that no work is undertaken which is conditional on permits, approvals, reviews, licences, fees, until all applicable conditions are met. No time extension will be allowed for delay in obtaining necessary permits.
- .5 Report to the Consultant in writing any condition which would prohibit granting of any permit or approval before work affecting such items is commenced.
- .6 Give notice of completion of project prior to occupancy, as required by applicable legislation.

### **2. BUILDING CODE, BY-LAWS, REGULATIONS**

- .1 Carry out work in accordance with requirements of the Ontario Building Code, latest issue, including all amendments and revisions.
- .2 Comply with requirements, regulations and ordinances of other jurisdictional authorities.
- .3 Where it is necessary to carry out work outside property lines, such as sidewalks, paving or concrete curbs, comply with applicable municipal requirements.
- .4 Promptly submit written notice to Consultant, of observed variance of Contract Documents from requirements of Building Code and authorities having jurisdiction. Assume responsibility for work known to be contrary to such requirements and performed without notifying Consultant.

### **3. CONSTRUCTION SAFETY**

- .1 Comply with requirements of GC 3.6.
- .2 Be governed by pertinent safety requirements of Federal or Provincial Governments and of municipal bodies having authority, particularly the Ontario Construction Safety Act, and regulations of Ontario Ministry of Labour, and work in conjunction with proper safety associations operating under the authority of Ontario Workers' Compensation Act.
- .3 Do not, in the performance of the work, in any manner endanger the safety or unlawfully interfere with the convenience of the public.
- .4 Notify the Ontario Ministry of Labour of intended work of this Contract as required by the Occupational Health and Safety Act. One copy of the "Notice of Project" shall be handed to Consultant.
- .5 The Contractor shall provide a staff person on site who is knowledgeable in the obligations of Occupational Health and Safety Act and will ensure that the requirements of the Act are fully complied with.
- .6 The Contractor shall pay all fees and assessments due under the Workplace Safety and Insurance Act.

### **4. FIRE PROTECTION**

- .1 Refer to technical Sections of Specifications and Drawings for fire protection requirements.
- .2 Test methods used to determine fire hazard classification and fire endurance rating shall be as required by Ontario Building Code.

## **SECTION 01410 - REGULATORY REQUIREMENTS**

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- .3 Upon request, furnish Consultant with evidence of compliance with project fire protection requirements.
- .4 Materials and components used to construct fire rated assemblies and materials requiring fire hazard classification shall be listed and labelled, or otherwise approved, by fire rating authority. Labelled materials and their packaging shall bear fire rating authorities label showing product classification.
- .5 Fire rated door assemblies shall include doors, frame, anchors and hardware and shall bear label of fire rating authority showing opening classification and rating.
- .6 Materials having a fire hazard classification shall be applied or installed in accordance with fire rating authority's printed instructions.
- .7 Fire rated assemblies shall be constructed in accordance with applicable fire test report information issued by fire rating authority. Deviation from fire test report will not be allowed.
- .8 Construct fire separations as continuous, uninterrupted elements except for permitted openings. Extend fire rated walls and partitions from floor to underside of structural deck above.
- .9 Fill and patch voids and gaps around openings and penetrations in and at perimeter of assemblies so as to maintain continuity and to produce a fire resistant smoke tight seal, acceptable to jurisdictional authorities and Consultant.

### **5. HAZARDOUS MATERIALS**

- .1 Comply with provisions of the Occupational Health and Safety Act as amended to include WHMIS (Workplace Hazardous Materials Information System).
- .2 Ensure that Material Safety Data Sheets (MSDS) are available on site prior to first delivery to site of any controlled material or substance.
- .3 Maintain on site for duration of Contract a hazardous materials log containing all required MSDS.
- .4 Log shall be open for inspection for Owner, Consultant and all personnel on site.
- .5 Ensure that workers are instructed in the purpose and content of MSDS.

### **6. WASTE MANAGEMENT**

- .1 Comply with applicable regulations of the Ministry of Environment governing waste management.
- .2 Prepare and submit waste audit and waste reduction plan and source separation plan in accordance with applicable regulatory requirements.

### **7. NON-SMOKING POLICY**

- .1 Pursuant to the Tobacco Control Act 1994, smoking is prohibited in public buildings at any time. This applies to anyone, anywhere on building property.

**END**



## SECTION 01450 - QUALITY CONTROL

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### 1. INDEPENDENT INSPECTION AND TESTING

- .1 Requirements specified herein apply to independent inspection and testing specified under technical Specification Sections, Divisions 2 to 16. Owner will pay separately for independent inspection and testing services.
- .2 Requirements specified herein do not apply to the following, which are the responsibility of the Contractor and which shall be paid for by the Contractor:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations and orders of public authorities.
  - .2 Testing, adjustment and balancing of mechanical and electrical systems and equipment.
  - .3 Inspection and testing performed exclusively for Contractor's convenience.
  - .4 Tests specified in Division 2 to 16 inclusive, to be included in Contract such as mill tests, certificates of compliance and testing to be carried out by Contractor under direction of Consultant.
- .3 Failure by independent inspection and testing agency to detect defective work or materials shall not in any way prevent later rejection, when such defect is discovered, nor shall it obligate Consultant for final acceptance.
- .4 Independent inspection and testing agency (hereinafter referred to as testing agency) is expected to do the following:
  - .1 Act on a professional and unprejudiced basis and carry out inspection and testing functions to establish compliance with requirements of Contract Documents.
  - .2 Check work as it progresses and prepare reports stating results of tests and conditions of work and state in each report whether specimens tested conform to requirements of Contract Documents, specifically noting deviations.
  - .3 Distribute reports as follows:
    - .1 Owner: 1 copy
    - .2 Consultant: 2 copies
    - .3 Subconsultants affected: 1 copy
    - .4 Contractor: 2 copies
    - .5 Building Department: 1 copy
- .5 Testing agency is not authorized to amend or release any requirements of Contract Documents, nor to approve or accept any portion of work.
  - .6 Contractor shall do the following:
    - .1 Notify testing agency minimum 48 hours in advance of operations to allow for assignment of personnel and scheduling of tests without causing delay in work.
    - .2 Provide testing agency with access to work at all times.
    - .3 Supply material samples for testing.
    - .4 Supply casual labour and other incidental services required by testing agency.
    - .5 Provide facilities for site storage of samples.
    - .6 Make good work disturbed by testing agency.
- .7 When initial inspection and testing indicates non-compliance with Contract Documents, any subsequent reinspection and retesting occasioned by non-compliance shall be performed by same testing agency and cost thereof borne by Contractor.

## **SECTION 01450 - QUALITY CONTROL**

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### **2. MOCK UPS**

- .1 Where required by Contract Documents construct mock-ups of work on site, in size and at location directed by Consultant.
- .2 Construct mock-ups prior to start of affected work. Allow sufficient time for Consultant's review. Work affected by mock-ups may not commence prior to acceptance of mock-up.
- .3 Construct mock ups to include all related specified materials and workmanship. Make revisions as directed by Consultant, in accordance with intent of Contract Documents, until mock-ups are acceptable.
- .4 Mock ups, reviewed and accepted by Consultant, shall become the standard of quality against which installed work will be measured.
- .5 Mock ups, by prior arrangement, may be incorporated into finished work if approved by Consultant.

### **3. TOLERANCES**

- .1 Unless specific tolerances are required by a Section of the Specifications or a referenced standard, meet the following non-cumulative tolerances for installed work:
  - .1 "plumb" shall mean plumb within  $\pm 3$  mm in 3 m, from true plumb
  - .2 "level" shall mean level within  $\pm 3$ mm in 3 m, from true level.
  - .3 "square" shall mean not in excess of 30 seconds less or more than 90°.
  - .4 "straight" shall mean within  $\pm 3$  mm in 3 m under a 3 m straightedge.

### **4. BUILDING ENVELOPE**

- .1 Requirements specified herein apply to all elements of the exterior building envelope.
- .2 Continuity of air barrier/vapour retarder and insulation components is critical and must be maintained at all locations. Where different systems meet, ensure proper interface and continuity between adjacent components by implementing suitable construction sequences and by using compatible materials only.
- .3 Provide control joints in exterior building components of design and spacing which will permit expansion and contraction of components without causing distortion, failure of joint seals, undue stress, cracking, bowing or other defects detrimental to appearance and performance. Review design and location of control joints with Consultant prior to start of work and follow directions given by Consultant.
- .4 Anchor exterior cladding components to structure in manner suitable to accommodate structural deflection and creep. Design anchorage to withstand expected wind loads, positive and negative, in accordance with applicable regulations.
- .5 Ensure that air spaces within exterior building components are firestopped in accordance with applicable regulations.
- .6 Ensure that air spaces on the outside of vertical air barrier/vapour retarder (walls) are constructed with adequate drainage provisions to the exterior.

### **5. DRAINAGE**

- .1 Lay out and construct work to ensure that positive drainage is provided to roof drains, floor drains, site drains and catch basins, as set in their final position, preventing undrained areas and ponding.
- .2 Ensure that allowable construction tolerances and structural deflection do not cause ponding of water.

## **SECTION 01450 - QUALITY CONTROL**

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- .3 Report to Consultant in writing prior to executing work affected, in case adequate drainage cannot be provided.

**END**

## **SECTION 01500 - TEMPORARY FACILITIES**

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### **1. GENERAL**

- .1 Provide all temporary facilities and controls required for the proper execution of the work.
- .2 Provide and maintain temporary systems in accord with applicable regulations and requirements. Arrange for, obtain and pay for any permits required.

### **2. TEMPORARY ELECTRICITY & LIGHTING**

- .1 Provide temporary electrical lighting and power system for use by all Sections.
- .2 Arrange, obtain and pay for service, including meter, of sufficient size to allow use of required tools and equipment and to ensure adequate lighting levels for the proper execution of work.
- .3 Install and maintain temporary electrical systems in accord with Construction Safety Association's "Temporary Wiring Standards on Construction Sites", the Ontario Electrical Code and other authorities having jurisdiction.

### **3. TEMPORARY HEATING**

- .1 Furnish equipment, labour and fuel to provide temporary heat as required for proper execution of work.
- .2 Heat enclosed building to minimum 15°C at all times until taken over by Owner. Provide intermittent heating up to 21°C as required for proper execution of work.
- .3 Use propane or natural gas heaters of a type where the flame is not exposed. Open flame heaters are not permitted.
- .4 Uniformly distribute heat to avoid hot and cold areas and to prevent excessive drying.

### **4. TEMPORARY VENTILATION**

- .1 Provide minimum 1 air change per hour for enclosed areas receiving architectural finishes.
- .2 Prior to commencement of work where hazardous or volatile adhesives, coatings or substances are used, install adequate mechanical ventilation.
- .3 Do not allow excessive build-up of moisture inside building.

### **5. TEMPORARY COMMUNICATIONS**

- .1 Provide site telephone service for duration of Contract until completion.
- .2 Make telephone available to Owner and Consultant.
- .3 Provide and maintain in operation on a separate line a fax machine on site for duration of Contract.
- .4 Make provisions to send and receive e-mails at site office for duration of Contract.

### **6. TEMPORARY WATER**

- .1 Provide temporary water supply, for use by all Sections.
- .2 Water shall be clean and non-staining.

### **7. TEMPORARY SANITARY FACILITIES**

- .1 Provide temporary toilet facilities, including handwash facilities, for all personnel on site.
- .2 Keep facilities clean and sanitary and provided with required supplies at all times.

## **SECTION 01500 - TEMPORARY FACILITIES**

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- .3 Except where temporary sanitary facilities are connected to municipal sewer system, periodically remove wastes from site.

### **8. TEMPORARY FIRST-AID FACILITIES**

- .1 Provide site equipment and medical facilities necessary to supply first-aid service to injured personnel in accordance with regulations of the Workers' Compensation Act. Maintain facilities for duration of Contract.

### **9. TEMPORARY FIRE PROTECTION**

- .1 Provide and maintain in proper working order at least four fire extinguishers on each floor, prominently placed, until completion of work.
- .2 Fire extinguishers shall be minimum 9 kg 4A 60BC type.
- .3 Remove fire extinguishers from site, upon completion of work or when directed by Consultant.
- .4 Where gas welding or cutting is to be done within 3 m or above combustible material, or above space that may be occupied by persons, interpose shields of noncombustible material. Tanks supplying gases for welding or cutting shall be placed at no greater distance from the work than is necessary and shall be securely fastened in an upright position. Such tanks shall be free from exposure to the sun or high temperature.

### **10. TEMPORARY USE OF NEW PERMANENT SERVICE & EQUIPMENT**

- .1 Do not use any new permanent service or equipment without Owner's written approval.
- .2 Where permission is granted to use permanent services and equipment provide competent persons to operate services and equipment; inspect frequently and maintain facilities in proper operating condition at all times.
- .3 Permanent services and equipment shall be turned over to Owner in "as new" and perfect operating condition.
- .4 Use of permanent systems and equipment as temporary facilities shall not affect the warranty conditions and warranty period for such systems and equipment. Make due allowance to ensure that Owner will receive full benefits of equipment manufacturers warranty after project takeover.

### **11. CONSTRUCTION AIDS**

- .1 Provide temporary stairs, ladders, ramps required for movement and placing of materials, equipment and personnel.
- .2 Provide mechanical hoisting equipment and fully qualified operators as required during construction.
- .3 Erect required scaffolding independent of walls, arranged to avoid interference with work of other Sections as much as possible.
  - .4 Provide and maintain required shoring and bracing in accordance with Construction Safety Act and other applicable regulations.
- .5 Shoring and all false work over one tier in height shall be designed and shall bear the stamp of a registered professional engineer, having experience in this field.
- .6 The use of explosive power tools will not be permitted under any circumstances unless equipped with a device which positively prevents free flight of the stud.

### **12. BARRIERS**

- .1 Protect public and workmen from injury.

## **SECTION 01500 - TEMPORARY FACILITIES**

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- .2 Provide and maintain required hoardings, barricades, guardrails, and lights in accordance with applicable regulations.
- .3 Unless otherwise indicated, provide around assigned work and storage areas 2.4 m high fencing, as follows:
  - .1 Steel pipe or tee posts driven into ground minimum 1 m at maximum 3 m o.c.
  - .2 50 mm hot dip galvanized chain link mesh wire tied to posts.
  - .3 Where required, for construction access, hinged, lockable chain link gates.

### **13. TREE PROTECTION**

- .1 Within Contractor's assigned work and storage areas and adjacent to designated access routes, protect existing trees and other plants scheduled to remain. Provide minimum 1.8 m high chain link fencing outside of dripline of trees or groups of trees and other plants.
- .2 Leave fenced areas undisturbed; do not use areas for storage, stockpiling or any other purpose. Do not dump or flush any contaminants in areas of tree feeder roots.
- .3 Do not attach rigging cables to trees.
- .4 Where limbs or portions of plants are required to be removed to accommodate new work, they shall be removed in accordance with accepted arboricultural practice.
- .5 Where root systems of protected trees adjacent to construction are exposed or damaged, they shall be neatly trimmed and the area backfilled with suitable material to prevent desiccation.
- .6 Where necessary give plants an overall pruning to restore the balance between roots and top growth and/or to restore appearance.
- .7 Except at locations where specific procedures are included in Contract Documents do not alter grades around existing trees/plants without first obtaining Consultant's consent and directions.

### **14. TEMPORARY CONTROLS**

- .1 Provide protective coverings to protect work against damage caused by weather, including but not necessarily limited to rain, snow, ice, wind, frost and excessive heat.
- .2 Provide wind breaks and sun shades to allow proper setting and curing of cementitious materials.
- .3 Protect building materials from freezing.
- .4 Prevent sprayed materials from contaminating air beyond application area, by providing temporary enclosures.
- .5 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- .6 Prevent tracking of mud and dirt from work area to paved surfaces. Construct mud trap at truck exit points. Clean paved surfaces daily as requested, removing mud and dirt with scrapers and shovels and subsequently wash surfaces to satisfaction of Owner and municipal authorities.

### **15. PEST CONTROL**

- .1 Provide rodent control and other pest control programs during construction, in accordance with requirements of jurisdictional authorities.

### **16. TEMPORARY DRAINAGE**

- .1 Provide and maintain adequate temporary pumping and drainage systems to keep excavations and structures free of water. Prevent flow of surface water into excavations. Locate sumps away from foundations. Prevent pumped water from carrying soil in suspension in sufficient quantity to cause

## **SECTION 01500 - TEMPORARY FACILITIES**

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settlement of adjacent earth. Provide sufficient standby equipment to ensure continuity of pumping systems.

- .2 Control drainage on site to prevent flooding, erosion and run-off onto adjacent properties as a result of construction operations.
- .3 Dispose of water containing silt in suspension in accordance with requirements of jurisdictional authorities.
- .4 Conform to sedimentation and erosion control requirements of the conservation authority having jurisdiction. Provide and maintain until completion of work or until directed by Consultant to be removed, sediment control devices at catch basins, drainage courses and at other locations on site as directed.

### **17. SIGNS**

- .1 Except as specified here do not erect any signs unless approved by the Consultant.
- .2 Erect signs relating to safety on the work, or mandatory regulation notices.
- .3 Prior to commencement of work wherein hazardous or volatile cements, coatings, or substances are used, barricade entire area and post adequate number of "NO SMOKING" signs.

### **18. FIELD OFFICE AND SHEDS**

- .1 Maintain, until completion of Contract, for Contractor's use, a temporary office as required for work, large enough to accommodate site administrative activities and site meetings, complete with light, heating and cooling equipment to maintain 21°C, ventilation, telephone, fax machine (on separate line), copier (not combination fax/copier), table and chairs. Do not store materials, tools, equipment in meeting area; keep clean and tidy.
- .2 Provide temporary covers, sheds and platforms of weatherproof construction as may be required for protection and preservation of materials, small tools, equipment which may be susceptible to damage.

### **19. TEMPORARY ACCESS**

- .1 Provide temporary granular access road to and around building to maintain equipment access to construction areas at all times. Upon completion of work, when no longer required, remove temporary access road.
- .2 Provide minimum 400 mm thick, 50 mm crushed limestone working mat as required to permit work being carried out under all site and weather conditions. Remove working mat when no longer required.
- .3 Place filter fabric below access road and working mat.

**END**

## **SECTION 01600 - PRODUCTS REQUIREMENTS**

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### **1. PRODUCT QUALITY**

- .1 Products supplied for work shall be new and as far as possible and unless otherwise specified, of Canadian manufacture.
- .2 Materials used for temporary facilities are not required to be new, provided they are structurally sound and in suitable and safe operating condition.

### **2. STANDARDS AND TERMINOLOGY**

- .1 Where a standard has been adopted by these Specifications, incorporate minimum requirements of such standard into the work. Where requirements of Specifications are more stringent than those of the standard, follow more stringent requirements.
- .2 Reference to standards, specifications, handbooks and manufacturer's catalogues refer to latest edition thereof and all amendments or revisions applicable at bid closing date, unless date suffix is included with document number.
- .3 Wherever words "acceptable", "approved", "satisfactory", "selected", "directed", "designated", "permitted", "inspected", "instructed", "required", "submit", or similar words or phrases are used in standards or elsewhere in Contract Documents, it shall be understood, that "by (to) the Consultant" follow, unless context provides otherwise.
- .4 Where the word "provide" is used in these Contract Documents, it shall be taken to mean "supply and install" unless specifically noted otherwise.

### **3. CERTIFICATION**

- .1 Building materials, components and elements specified without the use of trade or proprietary names shall meet requirements specified.
- .2 If requested by Consultant, submit evidence of meeting requirements specified. Evidence shall consist of certification based on tests carried out by an independent testing agency.
- .3 Certification based on previous tests for same materials, components or elements is acceptable. Certification shall be in form of written test reports prepared by testing agency.

### **4. AVAILABILITY AND SUBSTITUTIONS**

- .1 Products which are specified by their proprietary names or by part or catalogue number form the basis for Contract. No substitutes for these may be used without Consultant's approval in writing.
- .2 Where it is found that specified materials have become unavailable for incorporating into work, notify Consultant immediately of proposed substitution.
- .3 Proposed substitution shall be any top quality product considered by Consultant to be of equal quality and value to that specified, and suitable for purpose intended.
- .4 Products proposed as substitutions, and which are considered by Consultant to be suitable for purpose intended, but which are in his opinion of lesser value and quality than those specified shall only be accepted as substitution if reasonable credits are allowed for their use.
- .5 In order to substantiate equivalency of proposed materials, products or processes, submit samples, printed product descriptions, test data, installation instructions, standards, certification, sample, - guarantee/warranty forms, list of successful projects incorporating such proposals, and similar information requested by Consultant.
- .6 Whenever a substitute is proposed, any change to contract price as a result of acceptance of proposed product shall include any adjustments to adjacent structure or space in order to accept minor differences in size or weight between proposed items and corresponding specified items.
- .7 Prevent any substitution or request for substitution from delaying construction progress in any way.



## **SECTION 01600 - PRODUCTS REQUIREMENTS**

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- .8 Requests for substitution resulting from failure to place orders in time will not be entertained. Be responsible for ordering products in time to ensure their required delivery; bear all costs for failure to comply with these requirements.

### **5. PRODUCT HANDLING AND STORAGE**

- .1 Suitably pack, crate and protect products during transportation to site to preserve their quality and fitness for the purpose intended.
- .2 Store products in original, undamaged condition with manufacturer's labels and seals intact until they are being incorporated into completed work.
- .3 Handle and store materials in accordance with manufacturer's and supplier's recommendations and so as to ensure preservation of their quality, appearance and fitness for work.
- .4 Arrange materials so as to facilitate prompt inspection, and remove faulty, damaged or rejected materials immediately from site.

**END**

## **SECTION 01700 - EXECUTION REQUIREMENTS**

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### **1. EXAMINATION**

- .1 Examine the site, existing premises and surrounding areas and be fully informed as to the conditions and limitations under which the work has to be executed. Claims for additional costs will not be entertained with respect to conditions which could reasonably have been ascertained by an inspection prior to bid closing.
- .2 Prior to commencement of work, make careful examination of previously executed work, existing conditions, levels, dimensions and clearances. Promptly advise Consultant of unsatisfactory preparatory work and substrate conditions; commencement of work implies acceptance of conditions.

### **2. PROTECTION**

1. Ensure that no damage is caused to existing structures, buildings, foundations, pavement, fences, curbs, grounds, plants, property, utilities, services, finishes during the progress of Work. Repair and make good any damage caused at no extra cost to Owner to the complete satisfaction of the respective property owners and authorities having jurisdiction. Do not proceed with repairs or remedial work without written permission of the Consultant. Only trades specifically capable of performing the work will be allowed to make remedial or repair work.
- .2 Keep municipal roads clean of mud and debris resulting from construction traffic.
- .3 Prevent soiling of pavement due to spillage, mixing of material or any other cause. Make good any damage caused.
- .4 Protect new work from damage with suitable protective coverings.
- .5 Protect work during periods of suspension, regardless of reason for suspension.

### **3. SERVICES AND UTILITY SYSTEMS**

- .1 Consult with utility companies and other authorities having jurisdiction to ascertain the locations of existing services on or adjacent to site.
- .2 Information as to the location of existing services, if shown on the Drawings, does not relieve the Contractor of his responsibility to determine the exact number and location of existing services.
- .3 Give proper notices for new services as may be required. Make arrangements with authorities and utilities for service connections required.
- .4 Pay any charges levied by utilities or authorities for work carried out by them in connection with this Contract, unless specified otherwise.
- .5 Operate and maintain all utility systems affected by work of this Contract, until the building or specific portions thereof have been accepted by the Owner.
- .6 Report existing unknown services encountered during excavation to Consultant for instructions; cut back and cap or plug unused services. Be responsible for the protection of all active services encountered and for repair of such services if damaged.

### **4. SLEEVES, SUPPORTS, AND FASTENERS**

- .1 Unless specified in other Sections, furnish, set and secure inserts, hangers, sleeves, fasteners, adhesives, anchors and other supports and fittings required for proper installation of work.
- .2 Use exposed metal fastenings and accessories of same texture, colour and finish as base metal on which they occur.
- .3 Select appropriate type of anchoring and fastening devices and in sufficient quantity and in such manner as to provide positive permanent anchorage of unit to be anchored in position. Keep exposed fasteners to a minimum, evenly spaced and neatly laid out.

## **SECTION 01700 - EXECUTION REQUIREMENTS**

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- .4 Fasteners shall be of permanent type. Do not use wood plugs.
  - .5 Fasteners which cause spalling or cracking of material to which anchorage is being made shall not be used.
  - .6 Fasteners in contact with preservative pressure treated wood shall be stainless steel.
- 5. CONCEALMENT**
- .1 Conceal ductwork, piping, conduit and wiring located in finished areas, in ceiling spaces and furred construction unless specifically noted to be exposed.
  - .2 If any doubt arises as to means of concealment, or intent of Contract Documents in this connection, request clarification from Consultant before proceeding with portion of work in question.
- 6. CUTTING AND PATCHING**
- .1 Regardless of which Section of work is responsible for any portion of cutting and patching, in each case tradesmen qualified in work being cut and patched shall be employed to ensure that it is correctly done.
  - .2 Any cost caused by omission or ill-timed work shall be borne by party responsible therefore.
  - .3 Do not endanger any work by cutting, digging or otherwise altering, and do not cut nor alter any loadbearing element without written authorization by Consultant. Provide bracing, shoring and temporary supports as required to keep construction safely supported at all times.
  - .4 Cut holes carefully and not larger than required after they are located by Sections requiring them, using suitable equipment and tools.
  - .5 Patching and making good work shall be undetectable in finished work.
- 7. WORKMANSHIP**
- .1 All work shall be carried out in accordance with the best trade practice, by mechanics skilled in the type of work concerned.
  - .2 Products, materials, systems and equipment shall be applied, installed, connected, erected, used cleaned and conditioned in accordance with the applicable manufacturer's printed directions.
  - .3 Where specified requirements are in conflict with manufacturer's written directions, follow manufacturer's directions, but inform Consultant in writing prior to proceeding with affected work. Where specified requirements are more stringent than manufacturer's directions, comply with specified requirements.
- 8. LINES AND LEVELS**
- .1 Verify all elevations, lines, levels and dimensions as indicated and report errors, any conflicts, or inconsistencies to the Consultant before commencing work or as soon as discovered.
  - .2 Arrange to have building base lines laid out by an Ontario Land Surveyor.
  - .3 Accurately lay out work and establish lines and levels in accord with requirements of Contract Documents.
  - .4 Set up, maintain and protect permanent reference points and provide general dimensions and elevations for all Sections of Work.

## **SECTION 01700 - EXECUTION REQUIREMENTS**

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### **9. DIMENSIONS**

- .1 Check and verify dimensions wherever referring to work. Dimensions, when pertaining to work of another Section, shall be verified with Section concerned. Details and measurements of work which is to fit or conform with work installed shall be taken at site.
- .2 Do not scale Drawings. If there is ambiguity, lack of information or inconsistency, immediately consult Consultant for directions. Be responsible for extra costs involved through the disregarding of this notice.
- .3 Walls, partitions and screens shall be considered as extending from floor to underside of structural deck unless specifically indicated otherwise.

### **10. LOCATION OF FIXTURES**

- .1 Location of fixtures, apparatus, equipment, fittings, outlets, conduits, pipes and ducts shown or specified, but not dimensioned, shall be considered approximate.
- .2 Request direction from Consultant to establish exact location. Any relocation caused by Contractor's failure to request direction from Consultant shall be done by Contractor at no extra cost. Where job conditions require reasonable changes in indicated locations and arrangements, make changes at no additional cost.
- .3 Conserve space and coordinate with work of other Sections to ensure that ducts, pipes, conduits and other items will fit into allocated wall and ceiling spaces, while ensuring adequate space for access and maintenance.
- .4 Where ducts, piping and conduits are permitted to be exposed they shall be neatly and uniformly laid out parallel to adjacent building lines and parallel to each other where they run in the same direction. Review exposed installations with Consultant prior to start of work. At no cost to Owner make changes to exposed work as directed by the Consultant where such work is not installed in accordance with Consultant's prior review.
- .5 Except where locations are specifically noted on Drawings, install exposed mechanical and electrical fixtures including outlets, switches, thermostats, panels and other items, located on walls, in orderly and neatly laid out manner, lining up with each other and grouped together where possible. Review installation with Consultant prior to start of rough-in work. Relocate at no cost to Owner any work which does not meet this requirement.

**END**

## **SECTION 01720 - EXAMINATION & PREPARATION**

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### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- .1 Field engineering survey services to measure and stake site.
- .2 Recording of subsurface conditions found.
- .3 Survey services to determine measurement inverts for the Work.
- .4 Requirements and limitations for cutting and patching the Work.

#### **1.2 REFERENCES**

- .1 Owner's identification of existing survey control points and property limits.

#### **1.3 SURVEY REFERENCE POINTS**

- .1 Existing base horizontal and vertical control points are designated on Drawings.
- .2 Locate, confirm and protect control points prior to starting site Work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Consultant.
- .4 Report to Consultant when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

#### **1.4 SURVEY REQUIREMENTS**

- .1 Establish two (2) permanent bench marks on site, referenced to established bench marks by survey control points.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading.
- .4 Establish pipe invert elevations.
- .5 Establish lines and levels for mechanical and electrical work.

#### **1.5 SUBSURFACE CONDITIONS**

- .1 Promptly notify Consultant in writing if discovered surface or subsurface conditions at Place of Work differ materially from those indicated in Contract Documents.
- .2 Advise the Consultant of a reasonable assumption of probable conditions when determined.
- .3 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes or Change Orders set out in Section 01 29 00.

#### **1.6 EXAMINATION**

- .1 Inspect existing conditions, including elements or adjacent Work subject to irregularities, damage, movement, including Work during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of the Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.

#### **1.7 PREPARATION**

- .1 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

## **SECTION 01720 - EXAMINATION & PREPARATION**

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- .2 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

### **1.8 EXISTING SERVICES**

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or seal lines at cut-off points as directed by Consultant.

### **1.9 LOCATION OF EQUIPMENT AND FIXTURES**

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Consultant of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.

### **1.10 SURVEY RECORD**

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

**END OF SECTION**

## **SECTION 01740 - CLEANING**

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### **1. GENERAL**

- .1 Be responsible for cleanliness of assigned work areas to satisfaction of Consultant. Maintain work areas in neat and orderly condition at all times.
- .2 Periodically, or when directed by the Consultant, remove from work areas rubbish and waste materials.
- .3 Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- .4 Use cleaning material only on surfaces recommended by cleaning material manufacturer.

### **2. CLEANING DURING CONSTRUCTION**

- .1 Remove debris, packaging and waste materials frequently.
- .2 Keep dust and dirt to an acceptable level, as directed.
- .3 Remove oily rags, waste and other hazardous substances from premises at close of each day, or more often if required.
- .4 Clear sidewalks of snow and ice, adjacent to construction site.

### **3. FINAL CLEANING**

- .1 Upon completion of work, or, where work is phased, upon completion of each phase, thoroughly clean all surfaces and components. Provide professional cleaning by a recognized, established cleaning company, to allow Owner to occupy without further cleaning except where specifically indicated otherwise.
- .2 Remove stains, dirt and smudges from finished surfaces.
- .3 Clean exposed finished surfaces in accordance with respective material manufacturer's recommendations.
- .4 Clean mechanical and electrical fixtures and other fittings of labels, wrappings, paper and other foreign material.
- .5 Replace heating, ventilation and air conditioning filters if units were operated during construction. Clean inside of ducts, blowers and coils.
- .6 Remove from work areas all waste and surplus materials from all areas, including roofs and ceiling spaces.
- .7 Steam clean existing masonry which becomes an interior exposed wall surface.
- .8 Remove snow and ice from driveways, parking areas and walks.
- .9 Power wash paved surfaces.

### **4. DISPOSAL OF WASTE MATERIALS**

- .1 All waste materials resulting from construction activities belong to the Contractor and shall be removed and legally disposed unless clearly stated otherwise.
- .2 Separate recyclable/reusable materials to maximum extent possible from general waste stream and transport to recycling/reuse facilities.
- .3 Fires and burning of waste materials is not permitted on site.
- .4 Do not bury waste or materials on site.

**SECTION 01740 - CLEANING**

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- .5 Do not dispose of liquid waste or volatile materials into watercourses, storm or sanitary sewers.

**END**



## **SECTION 01770 - PROJECT CLOSEOUT**

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### **1. REFERENCE STANDARD**

- .1 Comply with provisions of OAA, OGCA Document No. 100, April 1997 "Take-Over Procedures" except as modified in these Specifications.

### **2. OPERATING AND MAINTENANCE MANUALS**

- .1 Provide operation and maintenance manuals in printed and in digital (pdf) format. Printed data shall be contained in D-ring binders with soft vinyl covers. Binders shall have clear plastic pocket at back of spine identification containing label "Operation and Maintenance Manual" and project name and volume number, if applicable. Each manual shall contain a title sheet listing project name, date and volume number and names and addresses of Contractors and Subcontractors, Consultant and Subconsultants.
- .2 Provide hard copy of operating and maintenance data, prepared on 8 1/2" X 11" sheets in printed or typewritten form.
- .3 Data shall be assembled in systematic order, generally following the specification format. Provide labelled, celluloid covered tabs fastened to hard paper dividers to identify different Sections.
- .4 Provide the following material as applicable to work of this Contract:
  - .1 List of contents. If more than one volume is required, provide a cross-reference contents page at front of each volume.
  - .2 Complete list of subcontractors and suppliers, showing name, address, telephone/fax numbers, name of contact person and description of work done.
  - .3 Complete list of products used in the work showing product name, part number or code and manufacturer for each listing; follow specification format.
  - .4 Copy of finish hardware list, complete with all amendments and revisions.
  - .5 Schedule of paints and coatings. Include sufficient explanation to fully identify each surface with the applicable paint or coating used. Enclose copy of colour schedule.
  - .6 Maintenance instructions for all finished surfaces.
  - .7 Brochures, cuts of all equipment and fixtures.
  - .8 Operating and maintenance instructions for all equipment.
  - .9 Valve manual.
  - .10 Controls schematics.
  - .11 Extended warranties.
  - .12 Maintenance contracts.
  - .13 Other data required elsewhere in Contract Documents or deemed necessary by Consultant.

### **3. EXTENDED WARRANTIES**

- 1. Definition: Warranty = guarantee.
- 2. Submission Requirements:
  - .1 Submit extended warranties as part of "Operating and Maintenance Manuals".
  - .2 Arrange extended warranties in systematic order matching Specification format. Include a

## SECTION 01770 - PROJECT CLOSEOUT

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table of contents listing warranties in same order.

- .3 Each warranty must show:
  - .1 Name and address of Project
  - .2 Name of Owner
  - .3 Section Number and Title
- .4 All extended warranties must be presented under Contractor's letterhead, seal and signature and must bear similar wording to that specified in Contract Documents.
- .5 Submit manufacturers' Product warranties in accordance with GC 12.3.6.

### 4. RECORD DRAWINGS

- .1 Prior to Substantial Performance obtain a CAD file of all Contract Drawings from Consultant in accordance with requirements specified in Section 01330, and transfer changes, revisions, deletions and additions made throughout the execution of the Work, from the set of prints kept on site to the CAD file.
- .2 Clearly and prominently mark each drawing "RECORD DRAWING prepared by \_\_\_\_\_ (name of Contractor).
- .3 Submit CAD file of record drawings and one set of whiteprints of updated CAD file to Consultant prior to application for Final Payment.

### 5. MAINTENANCE MATERIALS

- .1 Deliver to the location directed by Consultant maintenance materials as required elsewhere in these Specifications. Obtain receipt for delivered materials and submit copy of receipt to Consultant.
- .2 Package materials so that they are protected from damage and loss of essential properties.
- .3 Label packaged materials for proper identification of contents and project name.

### 6. OPERATING AND MAINTENANCE INSTRUCTIONS

- .1 Prior to requesting Substantial Performance, at a time acceptable to Owner and Consultant, but not before operating and maintenance data has been reviewed and accepted by Consultant, instruct designated Owner's representatives in the operation and maintenance of all systems and equipment.
- .2 Arrange training sessions for each type of operating system and equipment. Sessions shall be conducted by qualified instructors and shall be of sufficient duration and depth to adequately instruct participants.
- .3 Throughout the training sessions make reference to reviewed operation and maintenance manuals to familiarize participants with the data provided.
- .4 Prepare an attendance record for each training session, to be signed by each participant upon conclusion of session. Show date and time of session, subject of session and name, title and organization of each participant. Submit a copy of each record to Consultant.
- .5 Subcontractor whose work is subject of training session and Contractor shall be represented during training session by qualified personnel.

### 7. INSPECTION AND ACCEPTANCE OF WORK

- .1 Prior to requesting Substantial Performance submit the following:
  - .1 Three copies of operating and maintenance manuals (manuals must be submitted

## **SECTION 01770 - PROJECT CLOSEOUT**

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minimum 6 weeks prior to requesting Substantial Performance).

- .2 Inspection and acceptance certificates required from regulatory agencies.
- .2 Advise the Consultant in writing, when work has been substantially completed. If Consultant agrees that this stage has been reached, prepare a complete list of deficiencies and submit this list to Consultant.
- .3 On receipt of the above deficiency list in a satisfactory form, the Consultant, accompanied by Subconsultants, the Contractor and the Owner, if deemed desirable, will carry out an inspection of the Project.
- .4 Add to the deficiency list, in accordance with Consultant's directions, any additional deficiencies which are identified during inspection and reissue updated deficiency list.
- .5 Upon completion, inspection and acceptance of work, Owner will take over and occupy completed work. Refer to Supplementary Conditions for procedures relating to certification of Substantial Performance and release of holdback.

### **8. FINAL SUBMISSION**

- .1 Prior to claiming Final Payment do the following:
  - .1 Submit record drawings.
  - .2 Submit one complete set of reviewed shop drawings, folded to 8-1/2" x 11" size, contained in heavy duty manila envelopes, numbered and labelled. Follow specification format with no more than one Section per envelope.
  - .3 Submit maintenance materials.
  - .4 Submit a final accounting of all approved changes to the Contract Price, including adjustments to cash allowances.

### **9. WARRANTY INSPECTION**

- .1 The Contractor shall organize a warranty inspection to take place two weeks prior to the expiration of the standard one-year warranty. The Consultant, subconsultants, the Contractor, subcontractors and the Owner's representatives shall attend.

**END**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Laid sheet multi-ply geo-membrane with lapped joints.

**1.2 RELATED SECTIONS**

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 31 23 16 – Excavating.
- .3 Section 31 23 23 – Backfilling.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- .1 Terrafix Geotextile 270R or equivalent
- .2 Other acceptable manufacturers offering functionally equivalent products.

**EXECUTION**

**2.2 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify substrate surface is free of matter detrimental to application of membrane and lap seal tape.

**2.3 PREPARATION**

- .1 Protect adjacent surfaces not designated to receive protection.
- .2 Clean and prepare surfaces to receive membrane in accordance with manufacturer's written instructions.
- .3 Do not apply membrane or related components to substrate unacceptable to manufacturer.

**2.4 INSTALLATION**

- .1 Install membrane and tape seal in accordance with manufacturer's written instructions.
- .2 Roll out membrane. Minimize wrinkles and bubbles.
- .3 Overlap edges and ends minimum 600 mm.
- .4 Seal laps and joints with sealant tape or to manufacturer's specifications.
- .5 Reinforce membrane with multiple thicknesses of membrane material over static or moving joints.
- .6 Weather lap joints on sloped substrate in direction of drainage.
- .7 Extend membrane over intersecting surfaces at membrane perimeter minimum 600 mm.

**2.5 PROTECTION OF FINISHED WORK**

- .1 Do not permit traffic over unprotected or uncovered membrane.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Removal of surface debris.
- .2 Removal of trees, shrubs, and other plant life.
- .3 Topsoil excavation.

**1.2 RELATED SECTIONS**

- .1 Section 31 22 13 - Rough Grading.

**1.3 REGULATORY REQUIREMENTS**

- .1 Conform to all applicable codes for environmental requirements and disposal of debris.
- .2 Coordinate clearing Work with utility companies.

**PART 2 EXECUTION**

**2.1 PREPARATION**

- .1 Verify that existing plant life designated to remain is tagged or identified.
- .2 Identify a salvage area and waste area as required for placing removed materials.

**2.2 PROTECTION**

- .1 Locate, identify, and protect utilities that are to remain, from damage.
- .2 Protect trees, plant growth, and features designated to remain, as final landscaping.
- .3 Protect bench marks, survey control points, and existing structures from damage or displacement.

**2.3 CLEARING**

- .1 Clear areas required for access to site and execution of Work.
- .2 Remove trees and shrubs as indicated. Remove stumps, main root ball, and all surface rocks to a depth of 1m below grade.
- .3 Clear undergrowth and deadwood, without disturbing subsoil.

**2.4 REMOVAL**

- .1 Remove debris, rock, and extracted plant life from site.

**2.5 TOPSOIL EXCAVATION**

- .1 Do not excavate wet topsoil.
- .2 Stockpile in area designated on site to depth not exceeding 2.5 m and protect from erosion.
- .3 Remove excess topsoil not intended for reuse, from site.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
- .2 CSA International
  - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CSA A3000-08, Cementitious Materials Compendium.
- .3 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation
  - .1 OPSS 1004-05, Material Specification for Aggregates - Miscellaneous.
  - .2 OPSS 1010-04, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
- .4 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Co-ordination: arrange with authority having jurisdiction for relocation of buried services that interfere with execution of work.
  - .1 Pay costs of relocating services.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Granular B to OPSS 1010. Sand to OPSS 1004.
- .2 Granular A to OPSS 1010.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Evaluation and Assessment:
  - .1 Examine soil report if available.
  - .2 Before commencing work establish and verify locations of buried services on and adjacent to site.

**3.2 PREPARATION**

- .1 Temporary erosion and sedimentation control:

## SECTION 02300 - EARTHWORK

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- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Protection of in-place conditions:
- .1 Protect excavations from freezing.
  - .2 Keep excavations clean, free of standing water, and loose soil.
  - .3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
  - .4 Protect buried services that are required to remain undisturbed.
- .3 Removal:
- .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
  - .2 Remove stumps and tree roots below footings, slabs, and paving, and to 900mm below finished grade elsewhere.
  - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

### 3.3 EXCAVATION

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial regulations.
- .2 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
  - .1 Stockpile topsoil on site for later use.
- .3 Excavate as required to carry out work.
  - .1 Do not disturb soil or rock below bearing surfaces.
  - .2 Notify Consultant when excavations are complete.
  - .3 If bearings are unsatisfactory, additional excavation will be authorized in writing.
  - .4 Excavation taken below depths shown without Consultant's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .4 Excavate trenches to provide uniform continuous bearing and support for 150 mm thickness of pipe bedding material on solid and undisturbed ground.
  - .1 Trench widths below point 150 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .5 Excavate for slabs and paving to subgrade levels.
  - .1 In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

## **SECTION 02300 - EARTHWORK**

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### **3.4 FIELD QUALITY CONTROL**

- .1 Testing of materials and compaction of backfill and will be carried out by testing laboratory designated by Consultant.
- .2 Not later than 1 week minimum before backfilling or filling, submit to designated testing agency, samples of backfill and aggregate materials as required to perform moisture density relationship tests.
- .3 Do not begin backfilling or filling operations until material has been approved for use by Consultant.
- .4 Not later than 24 hours before backfilling or filling with approved material, notify testing laboratory to allow compaction tests to be carried out by designated testing agency.

### **3.5 BACKFILLING**

- .1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .2 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .3 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as fill.
  - .1 Fill excavated areas with gravel and sand as specified and compact as specified for fill.
- .4 Placing:
  - .1 Place backfill, fill and base course material in 200 mm lifts: add water as required to achieve specified density.
- .5 Compaction: compact each layer of material to following densities for material to ASTM D698:
  - .1 To underside of base courses: 95%.
  - .2 Base courses: 100%.
  - .3 Landscape areas: 85%
  - .4 Elsewhere: 95%.
- .6 In trenches:
  - .1 As per bedding detail.
- .7 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .8 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material
- .9 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

### **3.6 GRADING**

- .1 Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by Consultant.
  - .1 Grade to be constant between finished spot elevations shown on drawings.
  - .2 Grade away from building to be minimum 2% or as shown on drawings.

**END OF SECTION**



**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Excavating for building foundations.
- .2 Excavating for slabs-on-grade, paving, and landscaping.
- .3 Excavating for site structures.

**1.2 RELATED SECTIONS**

- .1 Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
- .2 Section 31 23 18 - Trenching: Excavating for utility trenches.
- .3 Section 31 23 16 - Excavating: Excavating for piling.
- .4 Section 31 23 23 - Backfilling.
- .5 Section 33 11 16 - Site Water Utility Distribution Piping.

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that survey bench mark and intended elevations for the Work are as indicated.

**3.2 PREPARATION**

- .1 Identify required lines, levels, contours, and datum locations.
- .2 Locate, identify, and protect utilities that remain from damage.
- .3 Notify utility company to remove or relocate utilities as specified.
- .4 Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- .5 Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs from excavating equipment and vehicular traffic.

**3.3 EXCAVATING**

- .1 Excavate subsoil to accommodate building foundations, slabs-on-grade, paving, site structures, and construction operations.
- .2 Compact disturbed load bearing soil in direct contact with foundations to 95% SPMD; perform compaction in accordance with Section 31 23 23.
- .3 Slope banks with machine as required by Provincial safety standards.

## **SECTION 02315 - EXCAVATING**

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- .4 Do not interfere with 45 degree bearing splay of foundations (area of soil below and outside of foundations).
- .5 Grade top perimeter of excavating to prevent surface water from draining into excavation.
- .6 Hand trim excavation. Remove loose matter.
- .7 Remove lumped subsoil, boulders, and rock up to 0.25 cu m measured by volume. Larger material will be removed under Section 31 23 17.
- .8 Notify Consultant of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- .9 Correct areas over excavated as specified in Section 31 23 23.
- .10 Stockpile excavated material in area designated on site as specified in Section 31 05 16; remove excess or unsuitable material from site.
- .11 Remove excavated material from site.

### **3.4 PROTECTION OF FINISHED WORK**

- .1 Section 01 78 40: Protecting installed work.
- .2 Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- .3 Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Excavating trenches for utilities from 1.0 m outside building (for sewers) and from building (for water works) to municipal or onsite utilities.
- .2 Compacted fill from top of utility bedding to subgrade elevations.
- .3 Backfilling and compaction.

**1.2 RELATED SECTIONS**

- .1 Section 31 05 13 - Soil Materials.
- .2 Section 31 05 16 - Aggregate Materials.
- .3 Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
- .4 Section 31 22 19 - Finish Grading: Filling of topsoil over back filled trenches to finish grade elevation.
- .5 Section 31 23 16 - Excavating: General building excavation.
- .6 Section 31 23 17 - Rock Removal: Removal of rock during excavating.
- .7 Section 31 23 23 - Backfilling: General backfilling.
- .8 Section 33 11 16 - Site Water Utility Distribution Piping: Water piping and bedding from building to onsite or municipal utilities.
- .9 Section 33 31 13 - Site Sanitary Sewerage Piping: Sanitary sewer piping and bedding from building to onsite or municipal utilities.

**1.3 REFERENCES**

- .1 MTO LS-706 Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg and a 305 mm Drop.
- .2 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .3 ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- .4 ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .5 ASTM D6938-15 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

**1.4 DEFINITIONS**

- .1 Utility: Any buried pipe, duct, conduit, or cable.

**1.5 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination:
  - .1 Coordinate with other work having a direct bearing on work of this section.
  - .2 Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

**PART 2 PRODUCTS**

**2.1 FILL MATERIALS**

- .1 Pipe Bedding Type: Granular 'A': As specified in Section 31 05 16 to a depth of 150 mm below the bottom of the pipe.
- .2 Sewer Pipe Cover Type: Sand Bedding (Granular 'B' Type II) to a height of 300 mm above the top of the pipe.
- .3 Water Works Cover Type: Granular 'A' as specified in Section 31 05 16 to a height of 300mm above the top of the pipe.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that survey bench mark, control point, and intended elevations for the Work are as shown on drawings.

**3.2 PREPARATION**

- .1 Identify required lines, levels, contours, and datum locations.
- .2 Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- .3 Protect bench marks, existing structures, fences, sidewalks, paving, curbs from excavating equipment and vehicular traffic.
- .4 Maintain and protect above and below grade utilities which are to remain.
- .5 Cut out soft areas of subgrade not capable of supporting structures. Backfill with clear stone to 150 mm below bottom of structure. Final 150 mm of backfill to be Granular 'A'.

**3.3 EXCAVATING**

- .1 Excavate subsoil required for utilities.
- .2 Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
- .3 Do not interfere with 45 degree bearing splay of foundations.
- .4 Hand trim excavation. Remove loose matter.
- .5 Remove lumped subsoil, boulders, and incidental rock.
- .6 Correct areas over excavated in accordance with Section 31 23 23.
- .7 Stockpile excavated material in area designated on site and remove excess material not being used, from site.
- .8 Remove excess excavated material from site.

**3.4 BACKFILLING**

- .1 Backfill trenches to contours and elevations with unfrozen fill materials.
- .2 Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

## **SECTION 02315.01 - TRENCHING**

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- .3 Granular Fill Type 'A': Place and compact materials in equal continuous layers not exceeding 200 mm compacted depth. Compaction to 100% SPMDD.
- .4 Granular Fill Type 'B': Place and compact material in equal continuous layers not exceeding 200 mm compacted depth. Compaction to 100% SPMDD.
- .5 Native Soil Fill: Place and compact material in equal continuous layers not exceeding 200 mm compacted depth. Compaction to 100% SPMDD.
- .6 Employ a placement method that does not disturb or damage foundation perimeter drainage, or existing utilities in trench.
- .7 Maintain optimum moisture content of fill materials to attain required compaction density.
- .8 Remove surplus fill materials from site.
- .9 Leave fill material stockpile areas completely free of excess fill materials.

### **3.5 TOLERANCES**

- .1 Section 01 73 00: Tolerances.
- .2 Top Surface of Backfilling: Plus or minus 25 mm from required elevations.
- .3 Top Surface of General Backfilling: Plus or minus 25 mm from required elevations.

### **3.6 FIELD QUALITY CONTROL**

- .1 Compaction testing will be performed to:
  - .1 MTO LS-706 Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg and a 305 mm Drop.
  - .2 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .3 ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
  - .4 ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
  - .5 ASTM D6938-15 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- .2 If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
- .3 Frequency of Tests: As directed by Consultant.

### **3.7 PROTECTION OF FINISHED WORK**

- .1 Section 01 78 40: Protecting installed work.
- .2 Reshape and re-compact fills subjected to vehicular traffic during construction.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Building perimeter, site structures, and backfilling to subgrade elevations.
- .2 Site filling and backfilling.
- .3 Fill under slabs-on-grade.
- .4 Fill under paving.
- .5 Fill for over-excavation.
- .6 Consolidation and compaction as scheduled.

**1.2 RELATED SECTIONS**

- .1 Section 31 05 13 - Soil Materials.
- .2 Section 31 05 16 - Aggregate Materials.
- .3 Section 31 22 13 - Rough Grading:
- .4 Section 31 23 16 - Excavating.
- .5 Section 31 23 18 - Trenching: Backfilling of utility trenches.
- .6 Section 33 11 16 - Site Water Utility Distribution Piping.
- .7 Section 33 46 13 - Foundation Drainage: Filter aggregate and filter fabric.

**1.3 REFERENCES**

- .1 MTO LS-706 Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg and a 305 mm Drop.
- .2 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .3 ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- .4 ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .5 ASTM D6938-15 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

**PART 2 PRODUCTS**

**2.1 FILL MATERIALS**

- .1 Native Soil: As specified in Section 31 05 13.
- .2 Granular 'B': As specified in Section 31 05 16.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- .3 Verify structural ability of unsupported walls to support imposed loads by the fill.

**3.2 PREPARATION**

- .1 Compact subgrade to density requirements for subsequent backfill materials.
- .2 Cut out soft areas of subgrade not capable of compaction in place. Backfill with clear stone or Granular 'B' fill and compact to density equal to or greater than requirements for subsequent fill material.

**3.3 BACKFILLING**

- .1 Backfill areas to contours and elevations with unfrozen materials.
- .2 Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- .3 Fill Type: Native Soil - Place and compact materials in equal continuous layers not exceeding 200 mm compacted depth. Compact to 95% SPMDD.
- .4 Fill Type: Granular 'B' - Place and compact material in equal continuous layers not exceeding 200 mm. Compact to 100% SPMDD.
- .5 Employ a placement method that does not disturb or damage other work.
- .6 Maintain optimum moisture content of backfill materials to attain required compaction density.
- .7 Backfill against supported foundation walls. Do not backfill against unsupported foundation walls.
- .8 Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- .9 Slope grade away from building minimum 2%.
- .10 Make gradual grade changes. Blend slope into level areas.
- .11 Remove surplus backfill materials from site.
- .12 Leave fill material stockpile areas free of excess fill materials.

**3.4 TOLERANCES**

- .1 Section 01 73 00: Tolerances.
- .2 Top Surface of Backfilling Under Paved Areas: Plus or minus 25 mm from required elevations.
- .3 Top Surface of General Backfilling: Plus or minus 25 mm from required elevations.

**3.5 FIELD QUALITY CONTROL**

- .1 MTO LS-706 Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg and a 305 mm Drop.
- .2 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .3 ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

## **SECTION 02315.02 - BACKFILLING**

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- .4 ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .5 ASTM D6938-15 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- .6 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- .7 Frequency of Tests: As directed by Consultant.

### **3.6 PROTECTION OF FINISHED WORK**

- .1 Section 01 78 40: Protecting installed work.
- .2 Reshape and re-compact fills subjected to vehicular traffic.

**END OF SECTION**



## **SECTION 02316 - ROCK REMOVAL**

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### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- .1 Removal of identified or discovered rock during excavation.

#### **1.2 RELATED SECTIONS**

- .1 Section 31 22 13 - Rough Grading.
- .2 Section 31 23 16 - Excavating: Building excavation.
- .3 Section 31 23 18 - Trenching: Trenching and backfilling for utilities.
- .4 Section 31 23 23 - Backfilling: Backfill materials.

#### **1.3 DEFINITIONS**

- .1 Incidental Rock: Solid mineral material with a volume of less than 1.0 cu m.
- .2 Boulder: Solid mineral material with a volume in excess of 1.0 cu m which may be removed with a mechanical excavator.
- .3 Bedrock: Solid mineral material with a volume in excess of 1.0 cu m that cannot be removed with a mechanical excavator.

#### **1.4 PRICE AND PAYMENT PROCEDURES**

- .1 Incidental Rock shall be considered incidental to the work and no additional payment shall for removal of these rocks. All Incidental Rocks shall be set aside for the Owner to be used as landscaping material, or removed from the site, as directed by the Consultant.
- .2 Boulder removal shall be an extra to the contract and will be negotiated between the Consultant and the Contractor. All Boulders shall be set aside for the Owner to be used as landscaping material, or removed from the site, as directed by the Consultant.
- .3 Bedrock removal shall be an extra to the contract and will be negotiated between the Consultant and the Contractor.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Removal of topsoil and, or subsoil.
- .2 Cutting, grading, filling, rough contouring, compacting the site for site structures and, or building pads.

**1.2 RELATED SECTIONS**

- .1 Section 31 05 13 - Soil Materials.
- .2 Section 31 05 16- Aggregate Materials.
- .3 Section 31 12 13 - Site Clearing.
- .4 Section 31 22 19 - Finish Grading: Finish grading with topsoil to contours.
- .5 Section 31 23 16 - Excavating: Building excavation.
- .6 Section 31 23 18 - Trenching: Trenching and backfilling for utilities.
- .7 Section 31 23 23 - Backfilling: General building area backfilling.

**1.3 REFERENCES**

- .1 MTO LS-706 Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg and a 305 mm Drop.
- .2 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .3 ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- .4 ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .5 ASTM D6938-15 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

**1.4 QUALITY ASSURANCE**

- .1 Perform Work to MTO OPSS 206.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Topsoil: as specified in Section 31 05 13.
- .2 Subsoil Fill: as specified in Section 31 05 13.
- .3 Structural Fill: as specified in Section 31 05 16.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that survey bench mark (if available) and intended elevations for the Work are as indicated.

**3.2 PREPARATION**

- .1 Identify required lines, levels, contours, and datum.
- .2 Stake and flag locations of known utilities.
- .3 Notify utility company to remove and relocate utilities if required.
- .4 Protect above and below grade utilities that are to remain from damage.
- .5 Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- .6 Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, and any other existing features from excavating equipment and vehicular traffic.

**3.3 SUBSOIL EXCAVATION**

- .1 Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded as required.
- .2 Excavate and process wet material to obtain optimum moisture content, where this material has been specified as an approved Soil Material.
- .3 When excavating through roots, perform work by hand and cut roots with sharp axe.
- .4 Remove excess subsoil from site.
- .5 Stockpile in area designated on site to depth not exceeding 2.5 m and protect from erosion or remove from site, if subsoil is not being reused.
- .6 Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key placed fill material to slope to provide firm bearing.
- .7 Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

**3.4 FILLING**

- .1 Install Work in accordance with MTO OPSS 206.
- .2 Fill areas to contours and elevations with unfrozen materials.
- .3 Place fill material on continuous layers and compact as follows:
  - .1 Native soils: 95% SPMDD
  - .2 Granular 'B': 100% SPMDD
  - .3 Granular 'A': 100% SPMDD
- .4 Maintain optimum moisture content of fill materials to attain required compaction density.
- .5 Slope grade away from building minimum 2%, unless noted otherwise.
- .6 Make grade changes gradual. Blend slope into level areas.
- .7 Remove surplus fill materials from site.

## **SECTION 02371 - ROUGH GRADING**

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### **3.5 TOLERANCES**

- .1 Top Surface of Subgrade: Plus or minus 30 mm from required elevation.

### **3.6 FIELD QUALITY CONTROL**

- .1 Section 01 45 00: Field inspection or testing.
- .2 Testing: To MTO LS-706 or ASTM D698.
- .3 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- .4 Frequency of Tests: as directed by Consultant.

### **3.7 SCHEDULES**

- .1 Common Fill:
  - .1 Fill Type: Granular 'B' - Maximum 200 mm compacted depth.
  - .2 Compact to minimum 100% of maximum density (SPMDD).
- .2 Pervious Structural Fill:
  - .1 Fill Type: Granular 'B' - Maximum 200 mm compacted depth.
  - .2 Compact to minimum 100% of maximum density (SPMDD).
- .3 Subsoil Fill:
  - .1 Fill Type: Native Soil (where specified as approved for use) - Maximum 200 mm compacted depth.
  - .2 Compact to minimum 95% of maximum density (SPMDD).
- .4 Topsoil Fill:
  - .1 Fill Type: Topsoil - Maximum 300 mm compacted depth.
  - .2 Compact to minimum 85% of maximum density.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Pipe and fittings for site water line including fire water line and domestic water line.
- .2 Valves, domestic water hydrants, and fire hydrants.

**1.2 RELATED SECTIONS**

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 31 23 16 - Excavating.
- .3 Section 31 23 18 - Trenching.
- .4 Section 31 23 23 - Backfilling.
- .5 Section 33 05 13 - Manholes And Catch Basins.

**1.3 REFERENCES**

- .1 MTO OPSS 441 – Construction Specification for Watermain Installation in Open Cut.
- .2 MTO OPSS 493 – Construction Specification for Temporary Potable Water Supply Services.

**1.4 GENERAL**

- .1 All Water Works shall be in accordance to OPSS 441 as modified by the PUC in the latest edition of PUC document “Special Provisions Waterworks” including all relevant PUC Standard Drawings. PUC document “Special Provisions Waterworks” has been included in this specification section in 1.5 below.
- .2 All Temporary Water Works shall be in accordance to OPSS 493 as modified by the PUC in the latest edition of PUC document “Special Provisions Waterworks” including all relevant PUC Standard Drawings. PUC document “Special Provisions Waterworks” has been included in this specification section in 1.5 below.
- .3 Water mains and services shall be constructed to the depth as shown on the drawings. Where depth is not specified on the drawings water main shall be constructed with a minimum of 2.0m cover, and all water services and hydrant leads shall be constructed with a minimum of 2.2m of cover.
- .4 Water mains shall be PVC DR 18 Class 235 (revised from 150 by AWWA) CSA approved for drinking water use or PVCO Class 235 conforming to AWWA c909. All bends (vertical and horizontal), valves, plugs, and all bends (vertical and horizontal), valves, plugs, all bends (vertical and horizontal), valves, plugs, tees, and fittings shall be mechanically restrained to manufactures specifications and the restraint schedule.
- .5 All pipes to be delivered to site with sealed end caps and to remain intact until installation.
- .6 Contractor will not be permitted to pressurize water mains for commissioning until adequate backfill has been placed on these lines and the contract administrator has approved the pressurization of the lines.
- .7 Water service piping for services 50mm or smaller shall be copper conforming to astm b88 and shall be type k soft copper.
- .8 All fittings and valves shall have approved, undamaged epoxy or similar coating from the manufacturer. All metal watermain fittings and valves shall be corrosion protected with a petrolatum system as follows;
  - 1) Corrosion protection materials shall be as manufactured by Denso North America. Corrosion protection materials shall be as manufactured by Denso North America or approved equal;

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- 2) A coating of petrolatum 'gel' shall be applied over all metal surfaces including nuts, a coating of petrolatum 'gel' shall be applied over all metal surfaces including nuts, bolts, rods, straps, and all connecting parts;
  - 3) Petrolatum/polystyrene molding compound shall be applied to provide smooth profiling petrolatum/polystyrene molding compound shall be applied to provide smooth profiling over the entire connection;
  - 4) Petrolatum tape shall be wrapped with air squeezed out over the molding compound of petrolatum tape shall be wrapped with air squeezed out over the molding compound of the entire connection;
  - 5) All work and methods shall be per manufacturer's instructions or specifications. All work and methods shall be per manufacturer's instructions or specifications.
  - 6) Anode protection, stainless steel hardware and components are not necessary or anode protection, stainless steel hardware and components are not necessary or required where the Denso (or similar approved) system, as described, is utilized.
- .9 The contractor will be responsible for the connection of the water works to the existing watermain in locations as indicated on drawings. The contractor will perform all work necessary to complete these connections including but not limited to: excavation, removal of existing thrust restraints, existing plugs, any additional watermain being removed, chlorinating & installing new components and backfilling area. The connections will be completed in the presence of a PUC Services operator and as per OPSS 441 in conformance with current provincial standards as amended by the PUC.
- .10 Water service construction may not begin until the PUC and the owner have executed a water service agreement. Connection of the water service to the municipal or local on-site water network may not be done until the PUC approves connection plan, and any required commissioning is complete. A licensed PUC operator must be present when the water service is connected to the municipal system.

### 1.5 PUC SPECIAL PROVISIONS WATERWORKS

- .1 W.1. GENERAL
- .1 These Special Provisions are provided as supplementary to OPSS 441 and OPSS 493 and are specifically for use on municipal watermain projects with test-pressures of 1,034 kPa (150 psi) constructed for the Public Utilities Commission of the City of Sault Ste. Marie. The Sault Ste. Marie Drinking Water System (DWS) including all watermain, services, valves and hydrants is owned by the Public Utilities Commission of the City of Sault Ste. Marie and is regulated under the Safe Drinking Water Act and regulations established under the Safe Drinking Water Act. The DWS is operated under provincial licence and permit by PUC Services Inc. For the purposes of the Contract, PUC Services Inc. and the Public Utilities Commission of the City of Sault Ste. Marie shall be considered Agents of the City of Sault Ste. Marie. Throughout this document, PUC shall mean the Public Utilities Commission of the City of Sault Ste. Marie or PUC Services Inc. as the case requires. PUC reserves the right to make updates or changes to this document at any time. PUC Services Inc. accepts no liability whatsoever for the unauthorized use of this document. These Special Provisions are requirements of the Contract.
- .2 The Contractor shall not operate any valve or hydrant or make any connection to mains or services in the existing distribution system, or on live mains (including temporary mains) within the contract limits, unless so directed by PUC. In the event of an emergency, the Contractor shall immediately contact the Contract Administrator and PUC.
- .3 As the Constructor, the Contractor shall retain control of the Work Area with respect to the Occupational Health and Safety Act, and make accommodations for PUC to access the site and execute specific tasks related to the operation and maintenance of the Sault Ste. Marie Drinking Water System for which PUC is the licensed Operating Authority. Specifically, PUC will operate and maintain the municipal drinking water system that remains in service within the Project Limits and the temporary potable water systems, once placed in service. Activities involved in operation and maintenance may include water quality sampling and testing, monitoring the contractor's work for compliance within the scope of the Safe Drinking Water Act, quality assurance, tapping in-service mains, pipefitting for connection to in-service mains, operation of valves and hydrants to control

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- flow or pressure in in-service watermains, flushing, and repair of in-service potable water systems.
- .4 The costs to comply with these Special Provisions shall be included in the Contract prices; no additional payment will be made to accommodate these requirements. These Special Provisions include amendments to Ontario Provincial Standard Specifications (OPSS) and shall be read in conjunction with the current issue of OPSS at the time of tender.
- .5 The most recent issue of the Ontario Provincial Standard Drawings (OPSD) shall apply as referenced or amended herein and in the Contract Documents.
- .6 In addition to National Sanitation Foundation (NSF), American Society of Mechanical Engineers (ASME), ASTM International, CSA, and American Water Works Association (AWWA) standards referenced in OPSS 441, the following standards shall apply as referenced or amended herein and in the Contract Documents:
- .1 AWWA B300-10 Hypochlorites
  - .2 AWWA C111/A21.11-12 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  - .3 AWWA C511-07 Reduced-Pressure Principle Backflow Prevention Assembly
  - .4 AWWA C600-10 Installation of Ductile-Iron Mains and their Appurtenances
  - .5 AWWA C605-13 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
  - .6 AWWA C651-14 Disinfecting Water Mains
  - .7 AWWA C655-09 Field Dechlorination
  - .8 Ministry of Environment and Climate Change, 2015. Watermain Disinfection Procedure.
- .7 The following PUC Standard Drawings shall apply.
- .1 WCS-1, Commissioning Temporary Services Rev 7
  - .2 WCS-2, Commissioning Watermains Rev 7
  - .3 WCS-3, Swab Retrieval and Flushing Rev 3
  - .4 WCS-4, Hydrostatic Pressure Test Rev 6
  - .5 WCS-5, Disinfection Assembly Rev 7
  - .6 WCS-6, Sample Site for Mains & Services 50mm Rev 3
  - .7 WCS-7, Sample Site for Mains & Services 50mm or Larger Rev 5
  - .8 WCS-8, Tracing Wire Detail at Hydrant Rev 4
  - .9 WCS-9, Backflow Enclosure Rev 4
  - .10 WCS-10, Manual Flushing Station Rev 3
  - .11 WCS-12, 50mm Diameter and Smaller Service Decommissioning Rev 4
  - .12 WCS 15, Curb Box Installation in Roadway Rev 1
  - .13 WCS 17, Watermain Tracing Copper & Plastic Services Rev 3
  - .14 WCS 18, Copper and Plastic Services Installation Detail Rev 3
  - .15 WCS 20, Bacteriological Sample Points – Rev 4
  - .16 WCS 21, Hydrant Installation Detail – Rev 1
  - .17 WM-1, Water Meter Installation Requirements for 16mm (5/8") to 25mm (1") meters Rev 10
  - .18 WM-2, Water Meter Installation Clearance Requirements for Large Meters Rev 13
  - .19 WM-4, Water Meter Installation for Residential up to 3 Units. Rev 3
- .2 W.2. DESIGN AND SUBMISSION REQUIREMENTS (OPSS 441)
- .1 441.04 Submittals
- Clause 441.04 amended by the addition of the following:
- This specification covers the requirements for submittals on the waterworks items of the Contract.

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### .2 441.04.01 Materials

Clause 441.04.01 is added:

The Contractor shall prepare a submittal listing manufacturer and part description for all waterworks materials for review and approval by the Contract Administrator within two (2) weeks of award. The Contractor shall provide manufacturer's certificates of product conformance with applicable standards upon request. No waterworks shall be installed prior to approval of the materials list.

The following submittals shall be required for all watermain pipe larger than 300 mm (12-inch) diameter:

- i) Shop drawings,
- ii) Letter of compliance from manufacturer, complete with proof of certification to applicable CSA, NSF and AWWA standards
- iii) Summary of fittings and method of restraint, including acceptance by the manufacturer, and
- iv) Installation guide

### .3 441.04.02 Backflow Preventers

Clause 441.04.02 is added:

Backflow preventers shall be delivered to the site in working condition and complete with recent certificate of testing by an OWWA Certified Tester and the certificate shall be submitted to, the Contract Administrator for verification. Backflow preventers shall be supplied in sufficient quantity, and be of such a size and capacity as to achieve required flush velocities.

### .4 441.04.03 Pipe Support

Clause 441.04.03 is added:

The Contractor shall submit drawing(s) sealed by a professional engineer and detailing temporary thrust restraint for existing watermains that are cut and capped, or otherwise dead-ended on a temporary basis.

The Contractor shall submit drawing(s) sealed by a professional engineer detailing a support plan where the work involves excavation parallel to an in-service watermain or where the work undermines an in-service watermain, and the Contract Administrator determines the work will compromise the soils supporting the in-service watermain.

Thrust restraint and support plans must be submitted for review/approval at least two (2) weeks prior to the work taking place.

### .5 441.04.04 Disinfection Plan

Clause 441.04.04 is added:

The Contractor shall submit a Disinfection Plan for each section of pipe being disinfected for approval by the Contract Administrator no less than 2 weeks in advance of the work. The plan shall describe:

- i. Schedule for swabbing, flushing, disinfection, de-chlorination, residual and bacteriological sampling;
- ii. List of materials and equipment to be used;
- iii. Proof of conformance of disinfectant with AWWA B300, latest edition;
- iv. The source water location, number and size of connections shown on a drawing of the connection including provisions to prevent backflow;
- v. The sequence pipes to be swabbed and flushed;
- vi. Description of the process for mixing disinfectant for the Continuous Feed Method;
- vii. Sampling locations;



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- viii. Method to prevent entry of trench water into watermains being swabbed and flushed;
- ix. Field de-chlorination plan according to AWWA C-655 and OPSS 441-07-27 as amended herein.

.6 441.04.05 Connection Plan

Clause 441.04.05 is added:

The Contractor shall submit a Connection Plan for each commissioned section of new watermain to the Contract Administrator for technical review and approval. The Connection Plan shall include:

- i) Schedule, including PUC monitoring of testing and connection;
- ii) Record drawings showing all differences, design changes and deviations from the original contract drawings in marked in red;
- iii) Plan drawing and list of all materials, equipment and labour required to carry out the connection;
- iv) The method of dewatering;
- v) Method of preventing movement of live watermain due to system pressure;
- vi) Proof of conformance of disinfectant with AWWA B300, latest edition.

The process to be used to disinfect connecting pipe in conformance with PUC standards.

.3 W.3. MATERIALS (OPSS 441)

.1 441.05.01 General

Clause 441.05.01 is amended by the addition of the following:

All non-metallic watermain and service pipe shall be supplied and installed complete with solid 12 gauge TWU copper or 14 gauge copper clad steel core tracing wire pipe to provide electrical continuity for location purposes. The wire must have a polyethylene insulated jacket suitable for protection against corrosion according to PUC drawing WCS-17. For HDD applications, minimum two (2) tracer wires shall be secured to the pipe and tracer wire for HDD shall be TWU 12 gauge copper clad with steel core.

Tracing wire splices shall be connected with waterproof connectors. Approved splices are as follows:

- i. Direct single wire to wire splices shall be DryConn King 6 Blue connectors or approved equal.
- ii. Service splices shall be DRYCONN Direct Bury Lug Aqua style connectors or approved equal.
- iii. Connection of tracing wire to copper service pipe to be made with Interprovincial Corrosion Control silicon bronze GA2XX series direct burial clamp for ½" to 1" services and GA3XX for 1-1/4" to 2" diameter services, or approved equal.

Petrolatum Tape Systems conforming to AWWA C217 shall be required for all mechanical restraint devices, hydrant boots, ductile iron fittings and valves. Petrolatum Tape Systems are NOT interchangeable and cannot be mixed. Petrolatum Tape Systems must be applied according to manufacturer specifications as a three part system, and shall include:

- i. Corrosion inhibiting petrolatum primer paste: Denso Paste S105 or Petrowrap Primer Paste,
- ii. Petrolatum molding mastic: Denso Profiling Mastic or Petrowrap 9190PM Profiling Mastic, and
- iii. Petrolatum tape: Denso LT Tape or Petrowrap LT Anti-Corrosion Tape.

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- .2 441.05.02 Ductile Iron Pipe Clause 441.05.02 is amended by the addition of the following:
- a) Ductile iron pipe will not be accepted for watermains unless specified in the Contract Documents.
  - b) Mechanical restrainers require the approval of the Contract Administrator and PUC. The following mechanical restrainers are approved for use on ductile iron pipe when used according to the manufacturer's instructions:  
DI Pipe to Mechanical Joint Fitting
    - Romac Grip Ring (100mm to 300mm diameter)
    - Clow Tuf-Grip DI Series (100mm to 300mm diameter)
    - EBAA Megalug Series 1100 (100mm to 300mm diameter)
- .3 441.05.03 Concrete Pressure Pipe Clause 441.05.03 is amended by addition of the following:  
Concrete pipe will not be accepted for watermains unless specified in the Contract Documents.
- .4 441.05.04.01 PVC Pipe General Clause 441.05.04.01 is amended by the addition of the following:
- a) Gray iron fittings will not be accepted.
  - b) Ductile fittings shall be Mechanical Joint (MJ) unless specified in the contract documents.
  - c) Ductile fittings shall be provided with cathodic protection according to OPSS 442 and OPSD 1109.011.
  - d) Injection moulded PVC fittings in sizes 100mm through 300mm shall conform to AWWA C907, latest edition, shall be UL listed and FM approved, and certified according to CSA B137.2.
  - e) Ductile Iron fittings used with non-metallic pipe shall be supplied according to OPSS 441.05.04 as amended by PUC and complete with sufficient quantity of Petrolatum Tape system to wrap the entire fitting and restrainers according to manufacturer's instructions and AWWA C217.
  - f) Mechanical restrainers require the approval of the Contract Administrator and PUC. The following mechanical restrainers are approved when used according to the manufacturer's instructions, in the range of pipe diameters noted:
    - i) Restraining PVC Pipe to PVC Injection Moulded Fittings
      - EBAA Iron Series 2600 (100mm to 300mm diameter)
    - ii) Restraining PVC Pipe Standard Bell and Spigot Push On Joints
      - Uni-Flange Series UFR-1399 (100mm to 300mm diameter)
      - EBAA Iron Series 1900 (100mm to 300 mm diameter)
      - STAR Pipe Products Series 1100G2 Bell Restrainers (100mm to 300mm diameter)
    - iii) Restraining PVC Pipe to Mechanical Joint Fitting
      - Uni-Flange Series UFR1500-CA Series (100mm to 300mm diameter)
      - Clow (Tyler-Union) Series 1500 TufGrip Dual Wedge (100mm to 300mm diameter)
      - EBAA Iron Series 19MJ00 (100mm to 300mm diameter)

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STAR Pipe Products Stargrip Series 4000G2 (100mm to 300mm diameter)

- .5 441.05.04.02 Polyvinyl Chloride Pipe (PVC)  
Clause 441.05.04.02 Polyvinyl Chloride Pipe is amended by addition of the following:
- a) The dimension ratio for C-900 PVC watermain pipe in sizes 100-300mm (4-12") shall be according to the contract documents, and shall be DR18 or heavier. IPEX Blue Brute PVC CIOD, Diamond Plastics C-900, Royal Building Products Royal Seal CIOD Pressure Pipe are accepted.
  - b) PVC watermain pipe in sizes 350 to 600 mm (14-24") shall be of dimension ratio and pressure class determined by the Engineer and shown on the contract documents.
- .6 441.05.04.03 Molecularly Oriented Polyvinyl Chloride (PVCO)  
Clause 441.05.04.03 Molecularly Oriented Polyvinyl Chloride Pipe (PVCO) is amended by addition the of the following:
- a) The following AWWA C-909 PVCO in sizes 100mm (6") through 300mm (12") is accepted:  
  
IPEX Bionax with Cast Iron Outside Diameter (CIOD) and a Pressure Class of 235 psi.
- .7 441.05.05 Polyethylene Plastic Pipe  
Clause 441.05.05 is amended by the addition of the following:
- a) Polyethylene plastic pressure pipe shall not be used for watermains or services unless specified in the Contract Documents.
  - b) Cross-Linked Polyethylene (PEX) shall not be used for watermains or services unless specified in the contract documents. When specified in the contract documents, cross-Linked Polyethylene (PEX) potable water service tubing for service connections shall be in accordance with ASTM F876-05, ASTM F877-05, CSA-B137.5-05 and NSF 61.
  - c) Where specified in the contract documents, PEX water service tubing is to be used with standard copper O.D. brass fittings as specified in OPSS 441.05.09.02 and 441.05.12 as amended. Stainless steel inserts shall be installed in PEX tubing ends. PEX services shall be complete with tracer wire according to OPSS 441.07.14 as amended and PUC drawing WCS-17.
  - d) Where PEX products are specified in contract documents, PEX service pipe shall be REHAU Municipex or IPEX Blue904 and minimum 25mm diameter.
- .8 441.05.06 Steel Pipe  
Clause 441.05.06 is amended by the addition of the following:  
  
Steel pipe shall not be used on watermains unless specified in the Contract Documents.
- .9 441.05.07 Copper Pipe  
Clause 441.05.07 is amended by the addition of the following:  
  
Copper pipe shall be clearly marked with NSF 61.  
  
Copper pipe shall be used for all water service pipes 50mm diameter and smaller unless alternative materials are specified in the contract documents.
- .10 441.05.08 Composite Pipe  
Clause 441.05.08 is amended by the addition of the following:  
  
Crosslink polyethylene/aluminum/crosslink polyethylene composite pressure pipe shall not be used unless specified in the Contract Documents.

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### .11 441.05.09.01 Valves - General

Clause 441.05.09.01 is amended by the addition of the following:

- a) Valve box assemblies shall be 5-1/4" slide type with length selected according to depth of valve..
- b) Approved material assemblies (no substitutions) are as follows:
  - i. Bibby VB2100 series, complete with cover (7362), guide plate (7339), top (7347), bottom section (7352), with extensions (737x)
  - ii. Sigma VB5000 Series including cover (825), centering ring (VB-875) top (VB-625), bottom section (VB-53x), with extension (VB 7x5).
  - iii. Star VB-5010-5 1/4" Adjustable Plow Valve Box composed of, VB514APTL-LID, VB514PT 12" top, 30" top extension VBDFT514D, 53" or 62" bottom and guide plate
  - iv. Mueller MVB\_0-2x Composite Valve Box complete with bottom, guide plate, lid and 27" adjustable top.
- c) Valves shall be supplied complete with sufficient quantity of Petrolatum Tape system according to OPSS 441.05.04 as amended by PUC to fully wrap the valve body from the bonnet down, according to manufacturer's instructions.

### .12 441.05.09.02 Service Line Valves

Clause 441-05.09.02 is amended by the addition of the following:

- a) Brass service line valves sized from 19 to 50 mm shall be according to AWWA C800. All brass in contact with potable water shall conform to NSF 372, or shall be certified to be made from copper alloy CDA No. 89520 or CDA No. C89833 "No-Lead" type, with a maximum lead content of 0.25% and clearly marked "EBII", "FD" or "NL".
- b) Brass services line valves in sizes 19mm to 50 mm shall be provided as follows:
  - i. Curb stops shall be Cambridge Brass Type 202NL-HxHx or Ford Meter Box Co. B44-xxx-Q-NL, or Mueller H-15209NL with compression fittings, or approved equal;
  - ii. For PEX services only, curb stops shall be Cambridge Brass Type 202NL-HxHEX with connection for tracer wire or approved equal;
  - iii. Corporation stops shall be Cambridge Brass Type 301NL-AxHEX, Ford Meter Box Co. FB1000-x-Q-NL type or Mueller B-25008NL, with AWWA Thread by Compression fittings.

### .13 441.05.09.03 Gate Valves

Clause 441.05.09.03 is amended by the addition of the following:

- a) Approved gate valves from 100mm to 300 mm diameter are:
  - i. Clow F6100 Series Model 2640
  - ii. Mueller A2360 Series
- b) Unless specified in the Contract Documents, end connections on valves shall be Mechanical Joint X Mechanical Joint except for tapping valves which shall be Mechanical Joint X Flange.

### .14 441.05.09.04 Butterfly Valves

Clause 441.05.09.04 is amended by the addition of the following:

Butterfly valves shall not be used unless specified in the contract documents.

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- .15 441.05.10 Hydrants  
OPSS 441.05.10 is amended by the addition of the following:
- a) Hydrants shall be Clow Canada Brigadier M-67 or Mueller Century and equipped with:
    - compression shut off
    - two piece barrel with flange at ground line
    - Two, 2-1/2 inch (65mm) hose nozzles with 12B Ontario Standard Thread (ULC-S513-1978)
    - One 4-1/2 inch (115 mm) steamer (pumper nozzle) with 33B Ontario Standard Thread
    - 150mm inlet connection with mechanical joint
    - non-rising spindle with o-ring seal
    - 32 mm (1.25in.) square operating- and cap-nuts
    - open counter-clockwise
    - factory painted yellow barrel and caps
    - drain holes internally plugged at the factory
  - b) The Contractor shall provide factory documentation confirming drain holes plugged. If such documentation is not available, the presence of drain plugs shall be confirmed with field testing prior to installation. The Contractor will be responsible for costs for field modifications to hydrants where plugs are found to be leaking within the warranty period.
  - c) Hydrants shall be supplied at an appropriate length to provide for required burial depth with 100-150mm flange elevation above finished grade without use of extensions. Hydrants shall be supplied complete with sufficient quantity of 8 mil polyethylene wrap tube conforming to AWWA C-105 to wrap the lower barrel from the hydrant base to grade level with two separate layers.
  - d) Tracer wire to be supplied and installed in sufficient quantity to loop and secure the wire around a hydrant cap for permanent attachment by PUC.
- .16 441.05.11 Double Check Backflow Preventers  
Clause 441-05-11 is deleted in its entirety and replaced by the following:
- a) Reduced pressure (RP-type) shall be according to CAN/CSA B64.4-07 and AWWA C511-07 and Double check valve assembly (DCVA-type) backflow preventers shall be according to CAN/CSA B64.5 and AWWA C510.
  - b) Prior to installation, backflow preventers shall be cleaned disinfected with 1-5% chlorine solution in accordance with AWWA C651. On the first installation, and each time it is disconnected and/or moved, all backflow preventers shall be re-certified and tagged by PUC prior to being placed in service. PUC reserves the right to reject backflow preventers PUC will not repair backflow preventers. PUC reserves the right to require recertification of backflow preventers at any time.
  - c) Removal of a backflow device from the project site will void the certification. PUC reserves the right to require re-certification of a backflow preventer at any time.
- .17 441.05.12 Service Connection Fittings and Appurtenances  
Clause 441.05.12 is amended by the addition of the following:
- a) Double studded broad band stainless steel service saddles with AWWA outlet shall be used for service connections to 150-300mm diameter PVC mains for all services 50mm in diameter and smaller. Approved saddles are:
    - i. Smith-Blair 372 series

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- ii. Romac 306 series
    - iii. Cambridge Brass 8403 series
  - b) Curb boxes shall be as follows:
    - i. Operating road shall be type 304 stainless steel with welded U-clip and stainless cotter pin of a length to place the top of the rod a minimum of 0.3 meters below the curb box cover.
    - ii. For services up to 25mm diameter, accepted products include:  
Mueller A-726 or  
Clow c/w D-10 cover, D-11 brass pentagon plug, T4 Rod, D-1 Base.
    - iii. For services 38mm and 50mm diameter, accepted products include:  
Mueller A-728  
Clow c/w D-10 cover, D-11 brass pentagon plug, T4 rod and D-2 base .
    - iv. Repair caps and repair couplings for newly installed curb boxes are not accepted.
  - c) Brass Service line couplings sized from 19 to 50 mm shall be according to AWWA C800. All brass in contact with potable water shall conform to NSF 372". Couplings shall be Cambridge Brass Type 119NL-HxHx, Ford Meter Box Co. C44-xx-Q-NL, or Mueller H-15403NL compression type.
  - d) Sacrificial zinc anodes shall be supplied and installed on each copper service according to OPSS 442.07.03.05 and OPSD 1109.011.
- .4 W.4. CONSTRUCTION (OPSS 441)
  - .1 441.07.01  
General Clause amended by the addition of the following:  

The work of installing watermains shall include installation of accessories including anodes, tracing wire, petrolatum tape systems and disinfecting and hydrostatic testing of the new waterworks systems.
  - .2 441.07.03 Removals  
Clause 441.07.03 shall be amended by addition of the following:
    - a) Remove and dispose of Existing Watermain Pipes  

The Contractor is responsible for designing and providing adequate thrust restraint at all locations where temporary dead-end watermains are created through the removal of existing watermains. The Contractor shall submit engineered stamped drawing(s) of the proposed thrust restraint for each dead end for review and approval by the Contract Administrator. Cut ends of existing watermains shall be fitted with one (1) temporary, 50mm blow off complete with 50mm corporation stop at the main and 50mm valve at the end of the blow off. The pipe and fittings shall be maximum 10 meters in length. Disinfection and installation shall be according to AWWA C651 and OPSS 441.07.22 as amended by PUC and shall be monitored by the Contract Administrator and a PUC water distribution operator.
    - b) When a hydrant is removed, the hydrant shall be removed and salvaged with its boot intact and delivered to PUC Services, Stores Department, 500 Second Line East, Sault Ste. Marie.
  - .3 441.07.13 Backfilling and Compacting  
Clause 441.07.13 is amended as follows:
    - a) Bedding and cover material shall be Granular "A" manufactured from natural stone unless directed otherwise by the Contract Administrator. Depth of bedding for watermain and services shall be according to the Contract documents and in no case less

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than 150mm. Cover material for watermain shall be minimum 300 mm above pipe. Cover material for water services 50mm diameter and smaller shall be 150 mm above pipe. Granular "A" used for bedding and cover shall not contain recycled asphalt pavement (RAP), slag or slag by-products. Compaction shall be according to OPSS and contract specifications.

b) Backfill material shall be approved by the Contract Administrator and free of organic inclusions or other contamination.

.4 441.07.14 Installation of Pipes

Clause 441.07.14 is amended by the addition of the following:

a) Watermains shall be laid to the elevation and grade shown on the construction drawings. No lateral deviation of more than 75 mm from line or 25 mm from grade will be allowed. Standard depth for water services is 2.2 meters. Changes to depth of bury shall be according to the contract documents or as approved by the Contract Administrator.

b) The Contract Administrator may raise or lower the invert of the watermain by up to 300 mm without constituting a Change in the Work.

c) For all crossings of sewer pipe over watermain, adjust grade to ensure a minimum clear separation of 500mm. For crossings of watermain over sewer pipe, ensure sufficient clear separation for proper bedding. Center one full length of watermain pipe and sewer pipe over/under the crossing. Clearance at crossings shall be approved by the Contract Administrator.

d) A continuous insulated tracer wire shall be installed with all PVC piping and hydrant leads, with a loop brought to the surface at each hydrant consistent with PUC Standard Drawing WCS-8.

e) A continuity test on the tracer wire shall be carried out by the Contractor under the supervision of the Contract Administrator prior to acceptance of the work.

.5 441.07.15.04 Polyvinyl Chloride Plastic Pressure Pipe

Clause 441.07.15.04 is amended by the addition of the following:

When installation of replacement (nitrile) gaskets is required, the work shall be checked by the Contract Administrator prior to assembly of pipes.

.6 441.07.16 Cutting of Pipe

Clause 441.07.16 is amended by the addition of the following:

a) All pipe shall be cut square, free of burrs and cut ends of PVC pipe chamfered according to manufacturer's instructions.

b) A new stop reference mark (insertion line) shall be clearly marked according to manufacturer's dimensions on cut pipe.

c) Cuts in copper and polyethylene pipe shall be made with a tubing cutter designed for use on the pipe to produce a clean cut edge free of burrs.

.7 441.07.17.03 Change in Line and Grade, Polyvinyl Chloride Plastic Pipe

Clause 441.07.17.03 is amended by the addition of the following:

Bending of PVC pipe barrel to achieve correct alignment shall not be allowed.

.8 441.07.18.01 Installation of Valves and Fittings

.9 Clause 441.07.18.01 is amended by the addition of the following:

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- a) Filter fabric shall be wrapped and secured around the base of all valve boxes and around the joint between the valve box top and the valve box extension to prevent entry of soils.
- b) All valve box sections shall be installed plumb and set vertically over the operating nut and guide plate in accordance with manufacturer's instructions. Minimum 150mm overlap is required between telescopic sections. The bottom section shall not restrict movement of the upper section. Valve box joints and base shall be wrapped with filter fabric to prevent entry of soils. The valve box shall be adjusted so that the lid is 5mm below the finished asphalt grade. Plow-type valve boxes shall be adjusted so the lid is flush with the finished asphalt grade.
- c) Apply Petrolatum Tape system according to manufacturer's instructions and OPSS 441.05 as amended by PUC to all ductile fittings and all valves.

### **.10 441.07.19 Installation of Hydrant Sets**

Clause 441.07.19 is amended by adding the following:

- a) All hydrants shall be set plumb and installed as required to ensure elevation and grade according to contract drawings without the use of hydrant extensions. Final elevation of break-away flange of the hydrant shall be 100 – 150 mm above finished grade. The contractor shall field verify the required hydrant length prior to installation. Hydrant extensions will not be accepted. Where a hydrant(s) is deemed by the Contract Administrator to be too short, the Contractor shall replace the hydrant in accordance with contract specifications prior to completing the hydrostatic test. The Contractor shall be responsible for all labour, materials, equipment and restoration required to replace the hydrant. Where a hydrant(s) is deemed by the Contract Administrator to be too long, the hydrant(s) will be cut to length and re-grooved by PUC. The Contractor will be billed \$1,000 per cut. The Contractor shall not be eligible for payment for any costs associated with correcting the final grade of hydrants.
- b) All joints on hydrants laterals shall be restrained using approved pipe restrainers..
- c) The Contractor shall be responsible for maintaining the hydrants free of stones, gravel or any other foreign material, which may enter during construction.
- d) The Contractor shall use only such wrenches as are approved by the Contract Administrator for operating the hydrants. Hydrant wrenches shall not exceed 30cm in length.
- e) Tracing shall be looped over a hydrant port according to WCS-8 for installation.
- f) Upon completion of the work (or after each use in freezing weather) all hydrants shall be pumped dry by the contractor.
- g) Petrolatum Tape system including paste, profiling mastic and tape shall be applied to each hydrant according to manufacturer's instructions and OPSS 441.05 as amended by PUC at the hydrant base and the mechanical joint connection.
- h) The lower barrel shall be wrapped with two separate layers of 8 mil polyethylene wrap conforming to AWWA C-105 from the hydrant base to grade level and secured with tape.
- i) Hydrants shall be installed as per WCS-21. The connection of the hydrant lead to the watermain shall be by a MJ X MJ X MJ tee fitting and MJ X MJ valve unless shown otherwise on the contract drawings.

### **.11 441.07.20 Installation of Service Connections**

Clause 441.07.20 shall be amended as follows:

- a) Service saddles for connections 50mm and smaller shall be double-studded, broad-band stainless steel service saddles. Direct tapping of PVC mains is not acceptable. Tapping of PVC mains through service saddles shall be done according to



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manufacturer's specifications. The tapping of the main shall be made with a proper cutting tool which must be a 'core cutter'. The use of regular twist bits, core saws or auger type bits is not allowed and taps made using these tools will be cause for non-acceptance of the pipe for installation. The coupon shall be retained for inspection by the Contract Administrator to ensure proper tapping procedures. Striations or 'crowning' of the coupon indicates improper tapping procedure or damaged tools and shall be cause for the Contract Administrator to reject the pipe.

- b) Curb boxes shall be marked with a blue-painted 50 x 50 x 1200mm stake.
- c) Curb boxes shall be plumb and in good working order.
- d) Curb boxes shall be 50mm below finished grade for lawns and gravel areas, or 5mm below finished grade for paved areas according to WCS-18. Use of repair caps will not be accepted. Curb boxes may be shortened by cutting the top section to length and threading the cut end and re-installing the cap.
- e) OPSD 1104.01 and 1104.02 water service connection detail applies.
- f) Services installed for future connection (no private pipe is available for connection), the service connection shall include a minimum of 1.0 metres of service pipe downstream of the curb stop, complete with brass coupling (compression by AWWA) and brass plug (AWWA thread).
- g) A sacrificial zinc anode shall be installed on each copper service according to OPSD 1109.011 and OPS 442.07.03.05.
- h) Water service laterals shall be installed with a minimum of 2.2 meters cover below finished grade. Where private service piping is shallow, adjust to grade on private side of curb box. Insulate water services at ditch crossings and other areas where cover is less than 2.0m as shown on the drawings. Insulation material shall be 50 mm, extruded expanded polystyrene meeting the requirements of OPSS 1605 having a minimum compressive strength of 690 kPa as per OPSS 1605.05 type "C" and shall be installed according to drawings. Cutting of insulation materials shall be with a sharp knife or saw to produce a clean straight edge. Include insulation in the unit bid price.
- i) Avoid installation of curb stops in sidewalk or driveways. PUC may, at its sole discretion, reject services installed in driveways and sidewalks.
- j) All trenching and backfilling shall conform to OPSS 401 with 150 mm cover.
- k) After new watermain has passed required tests and is put in service the PUC meter staff will transfer services from the temporary supply to the new system. Scheduling access for service transfers involving meter re-installation shall be by the contractor. Notice of such schedule shall be provided to PUC at least 48 hours in advance. The contractor will carry out transfers of temporary services connected at the curb stop under the supervision of the Contract Administrator. The Contractor shall notify all affected consumers at least 24 hours in advance of the interruption.
- l) Approved tracing wire shall be installed on water services in accordance with WCS-17. The tracing shall be connected to the tracing wire on the watermain with an approved splice connector. Tracer wire shall be connected to copper water services with an approved clamp. If PEX are specified in the Contract Documents, a tracing wire shall be installed in accordance with WCS-17 on the PEX service and connected to the electrical lug on the curb stop and an approved splice connector to ensure continuity on the tracer wire from the meter to the watermain.
- m) The Contractor is advised of a possible electrical safety hazard caused by stray current in metallic water service piping used to ground electrical systems. The Contractor is advised to consult the Electric and Utility Safety Association Safe Practice Guide and to implement appropriate measures to protect worker safety.
- n) Grounding for Water Services.
- i. Existing water service connections shall not be cut within 3.0 meters of the serviced building without prior approval from the Contract Administrator.

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ii. Where new water service pipe is connected to an existing galvanized or lead water service pipe and the connection is made within 3.0 meters of the building being serviced, the building electrical system shall be grounded from the electrical service panel using ground rods or approved equal or the galvanized/lead service replaced.

iii. Where new water service pipe is connected to an existing copper water service and the connection is made within 3.0 meters of a building, a ground plate or approved equal shall be bonded to the private side of the water service connection.

iv. Installation and materials shall conform to the latest edition of the Ontario Electrical Safety Code. A copy of the Electrical Safety Authority Authorization shall be issued to the Contract Administrator. The work of grounding services shall be undertaken by a Licensed Electrical Contractor. The Contractor shall complete all grounding to Electrical Safety Authority requirements prior to cutting existing water service connection pipe within 3.0 meters of a building. The method of grounding services shall be determined by the Contract Administrator.

.12 441.07.21 Shutting Down or Charging Mains

Clause 441.07.21 shall be amended by the addition of the following:

a) The Contractor shall not operate valves or hydrants outside the limits of the contract, or on live mains larger than 37mm (including temporary mains) within the contract limits unless a PUC Operator licensed under the Safe Drinking Water Act is present and monitoring the work.

b) At any time before the expiry of the guarantee period, in an emergency, the PUC may operate valves, and repair damage to the water system to prevent excessive loss of water and damage to property and to restore service to consumers. PUC may perform such work without prior notification to the Contractor, and may recover the cost of repairs from the contractor.

.13 441.07.22 Connections to Existing Watermains

Clause 441.07.22 shall be amended by addition of the following:

a) This section applies to all connections to in-service watermains for the purposes of obtaining temporary supply, temporary water services and final connections of new watermain.

b) The Contractor shall prepare and submit a Connection Plan for approval by the Contract Administrator at least two weeks prior to making a connection to in-service watermains.

c) Following approval by the Contract Administrator, the Contractor shall request a date for connection through the Contract Administrator at least 48 hours (2 business days) in advance to allow PUC to schedule an appropriately licensed operator and determine any special measures required. As a condition of scheduling the work, the Contractor shall demonstrate to the satisfaction of the Contract Administrator that all materials necessary to complete the work are on site and the Record Drawings shall have been accepted by the Contract Administrator.

d) Tapping of existing watermains for temporary water supply shall be undertaken by PUC in a safe excavation and with materials provided by the Contractor unless otherwise specified in the Contract Documents. All other cutting into, capping and connections to existing watermains including temporary and final connections shall be monitored by a PUC Water Distribution Operator, licensed under the Safe Drinking Water Act according to the provisions of the Safe Drinking Water Act. Availability of the PUC Operator is subject to operational requirements in the Drinking Water System. PUC accepts no responsibility for project delays resulting from operational requirements.

e) The Contractor shall not initiate the connection without written approval from the Contract Administrator.

f) Failure by the Contractor to attend at the scheduled time with labour and materials listed in the approved plan may result in cancellation of the connection.

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- g) Temporary water supply for commissioning of watermains and services shall be in accordance with paragraph (d) and the following requirements:
- i) The length of 50mm diameter temporary supply connections shall not exceed 10 meters when measured between the supply watermain and the backflow preventer. The new piping, fittings and valves required for the connection shall be spray-disinfected and swabbed with a minimum 1% and maximum 5% solution of chlorine just prior to being installed. If a length greater than 10 meters is required the pipe shall be disinfected and tested in accordance with paragraph (m), Final Connections of New Watermains prior to connection.
  - ii) Temporary supply connections of diameter 100mm and larger shall be disinfected and tested in accordance with paragraph (m), Final Connections of New Watermains, prior to connection.
  - iii) Temporary supply from fire hydrants may be permitted by the Contract Administrator subject to use of an approved connection method that ensures the hydrant will be available for Fire Department use. Only PUC may operate the hydrant. The contractor shall not operate or connect to the hydrant without a PUC monitor present to oversee the hydrant disinfection, flushing and connection.
  - iv) Where a hydrant is used for a source for commissioning a temporary potable water supply system, the length of 50mm diameter piping measured between the hydrant and the backflow preventer shall not exceed 10 meters. If temporary piping is larger than 50mm diameter, the maximum length is 6 meters to the backflow preventer. The new piping, fittings and valves required for the connection shall be spray-disinfected and swabbed with a minimum 1% and maximum 5% solution of chlorine just prior to being installed. Operation of hydrants shall be by PUC.
  - v) All disinfection must be monitored by PUC.
- h) RP backflow preventers are required on all temporary connections used for testing and disinfecting watermains and services. DCVA or RP backflow preventers shall be used on all connections for temporary water service systems.
- i) Backflow preventers shall be supplied by the contractor complete with a well-drained, tamper resistant enclosure with provisions for installation of a pad lock consistent with PUC Standard Drawing. The connection to the existing distribution system shall be done in a secure location and protected from freezing.
  - j) Anodes shall be installed at all connections by cadweld to existing cast iron or ductile iron piping according to OPSS 442.07.03.03, OPSS 442.07.06 and OPSS 442.07.07.
  - k) Watermains shall be cut back to remove all temporary taps as part of final connections.
  - l) The Contractor shall ensure that the workers undertaking the disinfection process thoroughly wash their hands with antibacterial soap and use hygienic practices, and that care is taken to prevent entry of materials into the watermain.
  - m) Final Connections of New Watermains. The Contractor shall dewater the watermains and trench in a controlled manner to not allow backflow into the watermains and disinfect the connection watermain piping and fittings as outlined below:
    - i) Connections Equal to or Less Than 6 meters:  
For a final connection length equal to or less than one pipe length, the new piping, fittings and valves required for the connection shall be spray-disinfected and swabbed with a minimum 1% and maximum 5% solution of chlorine just prior to being installed. The contractor will make provision for PUC to collect bacteriological samples as required. Failure of test results may at the option of the Contract Administrator and/or PUC require flushing and re-sampling or removal and re-disinfection of the connection. The contractor shall not be eligible for additional claims resulting from failed bacteria tests.

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ii) Connections Greater than 6 meters:

Connections greater than 6 meters in length require the approval of the Contract Administrator. In the event that the final connection point of the new watermain to the existing watermain distribution system is in a location that is deemed by the Contract Administrator to require a connection length greater than one pipe length, the new piping, fittings and valves required for the connection shall be assembled, disinfected and sampled for bacteria aboveground in accordance with AWWA C651. The pipe shall be properly supported and shall be guarded with a suitable mat or tapping blanket to contain the pipe in the event of breakage during testing. All pipe ends shall have restrained caps installed using restraints approved for use above grade. Flushing and Disinfection requirements of Clause 441.07.25 shall apply as amended herein.

Only after satisfactory chlorine residual and bacteriological results have been achieved, shall the pre-assembled connection be installed. The pre-assembled watermain shall not be drained following the start of chlorine residual and bacteriological testing protocol until just prior to the installation. All caps shall be kept in place during the installation procedure until immediately prior to making the connection.

n) If, in the opinion of PUC or the Contract Administrator, the work practices are deemed to be unsanitary or substandard for any reason, the work shall be stopped, and the Contractor shall, at his cost, make good and/or resolve the deficiency to the satisfaction of the PUC and the Contract Administrator.

o) If, in the opinion of PUC or the Contract Administrator, there is risk of contamination having occurred, the contractor shall flush and disinfect the watermain as directed by the Contract Administrator and/or PUC. PUC reserves the right to require additional bacteriological samples and the Contractor shall have no claim for additional charges for additional flushing, disinfection or sampling.

.14 441.07.23 Thrust Restraints

Clause 441.07.23 shall be amended by adding the following:

a) Concrete thrust blocking and mechanical joint restraints, when required, shall be placed as shown on the construction drawings or as directed by the Contract Administrator. Bolts on mechanical restraints shall be tightened to manufacturer's specifications using a torque wrench. Over-tightening of bolts on restraints and mj fittings shall be cause for the Contract Administrator to reject the pipe.

b) Petrolatum tape system shall be applied to all mechanical restraint devices according to OPSS 441.05.04 as amended by PUC and manufacturer's instructions.

.15 441.07.24.01 Hydrostatic Testing (General)

Clause 441.07.24.01 shall be amended by the addition of the following:

a) The Hydrostatic Test shall be monitored by a representative of the PUC.

b) Hydrostatic testing with riser pipe above grade will not be accepted unless a mat or tapping blanket or other protection method accepted by the Contract Administrator has been installed.

c) Pumping carried out to maintain pressure during the test shall be by means of a small pump of such a capacity as to make accurate adjustments to the pressure.

d) The pipe shall be filled slowly and trapped air shall be relieved.

e) Only potable water from the distribution system may be used for hydrostatic tests.

.16 441.07.25 Flushing and Disinfecting Watermains

Clause 441.07.25 is deleted in its entirety and replaced by the following:

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a) All new parts of drinking water systems in contact with drinking water, including temporary and new watermains shall be disinfected and tested in accordance with AWWA C651 and MOECC requirements as amended by PUC. The same requirements for watermains shall apply to hydrant leads and services larger than 37mm diameter. Services 37mm diameter and smaller shall be cleaned and flushed prior to being put in service. The basic disinfection procedure consists of the following:

- i. Inspect materials to ensure integrity and sanitation.
- ii. Prevent contaminating materials from entering the watermain during storage, handling and construction.
- iii. Isolate the new pipe from the distribution system with approved backflow preventer(s);
- iv. Load swabs and gradually fill the main.
- v. Flush in sequence and in accordance with an accepted plan.
- vi. Disinfect using the Continuous Feed Method according to AWWA C651, as amended herein.
- vii. Flush to de-chlorinate until the chlorine residual is equal to the source water, as confirmed by the Contract Administrator and PUC.
- viii. Sampling for bacteria in two consecutive rounds as carried out by PUC, over approximately 24 hours after the Contractor completes the de-chlorination process, and subsequent submittal for laboratory analysis.

b) The Contractor shall submit a Flushing and Disinfection Plan for approval by the Contract Administrator and PUC at least two weeks prior to the work. The implementation of the plan shall be under the supervision of the Contract Administrator, and shall be monitored by PUC.

c) Swabbing & Flushing

- i. The supply for flushing must provide enough flow to create a velocity of 3 feet per second (0.91 m/s) in the pipe being flushed. If adequate velocity is not provided, additional tap(s) and supplies will be required unless otherwise approved by the Contract Administrator.
- ii. New watermains and branches shall be filled from a potable supply prior to flushing and swabbing.
- iii. All pipe and branches shall be flushed and swabbed and with sufficient volume to exchange at least 3 pipe volumes unless otherwise approved by the Contract Administrator.
- iv. A riser pipe shall be installed at each swabbing outlet to ensure the pipe flows full, and to prevent entry of trench water. The riser pipe shall be supported to prevent damage to the watermain.
- v. Hydrant leads must be manually cleaned and swabbed a minimum of two (2) passes using a new swab and a 1-5% chlorine solution.
- vi. All swabs shall be new. Swabs shall not be re-used. Swabs shall be one size larger than the pipe in which they are used.
- vii. Swabs shall be numbered, dated, and a count of swabs used and recovered shall be made to ensure that all swabs and parts thereof have been retrieved from the system. The Contractor and the Construction Administrator shall co-sign a record confirming retrieval of all swabs.
- viii. At least two (2) swabs will be used for each pipe. Swabbing shall be repeated until minimum one (1) clean swab (no discoloration of swab) and measured turbidity is consistent with the drinking water system. Velocity during flushing shall be 0.91 m/s (3 ft/s) unless otherwise approved by the Contract Administrator and the PUC representative.

d) Disinfection

## SECTION 02511 - SITE WATER UTILITY DISTRIBUTION PIPING

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- i. Disinfection shall be carried out using the Continuous Feed Method described in AWWA C651 as amended in accordance with MOECC and PUC requirements.
- ii. The Contractor is advised that there are health and safety risks associated with handling sodium hypochlorite, calcium hypochlorite and the chlorine solutions used for disinfection. The Contractor shall ensure all their Employees understand and engage in safe handling practices.
- iii. Liquid chlorine solution shall be introduced at a constant concentration of not less than 50 mg/L and not more than 125 mg/L. Liquid chlorine solution shall be introduced so that the chlorine is distributed uniformly throughout the section being disinfected. Access points for chlorination shall be within 3 meters of all dead ends. The chlorine shall be applied until the chlorine concentration in the pipe reaches the applied concentration throughout the section. The system shall be left charged with the chlorine solution for 24 hours during which time valves, hydrants and curb stops will be operated to ensure disinfection of appurtenances.
- iv. Sampling and testing for chlorine residual will be carried out by PUC. The maximum allowable decrease in chlorine concentration after 24 hours is 40% of the initial concentration. If all residual tests meet the chlorine loss criteria, the section shall be flushed completely and recharged with water normal to the operation of the system. If chlorine loss criteria are exceeded, flushing and disinfection procedures shall be repeated until satisfactory results are obtained.
- v. PUC will collect two consecutive sets of bacteriological samples from sample locations required in accordance with AWWA C651, MOECC and PUC procedures. PUC reserves the right to require additional sampling locations. A single failed bacteriological test will constitute a failure of that entire sampling round and will necessitate repeating the disinfection process. Should subsequent failures of bacteriological tests occur, the Contractor may be directed by the Contract Administrator to locate and eliminate the source of contamination. The Contractor shall not be eligible for financial claims as a result of failed bacteriological tests.
- vi. The contractor is advised that bacteriological test results typically take 4 business days from the date of sampling. The contractor shall not be eligible for any reimbursement resulting from delays in sampling and analysis.
- vii. The Contractor shall under no circumstance initiate connection until such time as authorization is provided by the Contract Administrator, based on satisfactory test results, approval from PUC, and the presence of a PUC operator licensed under the Safe Drinking Water Act to monitor the connection process.
- viii. After the watermain connection has been installed, the PUC and/or the Contract Administrator may elect to conduct additional chlorine residual and bacteriological testing in accordance with the requirements outlined for new watermains to verify the disinfection of the watermain. If the watermain connection fails either the chlorine residual or bacteriological requirements, PUC and/or the Contract Administrator will provide directions for corrective action and the Contractor shall cooperate fully without additional charge.

.17 441.07.26 Site Restoration

Clause 441.07.26 is amended by the addition of the following:

Restoration shall include all site restoration required due to installation and/or removal of temporary water systems.

.18 441.07.27 Management of Excess Material

Clause 441.07.27 is amended by the addition of the following:

- a) Safe disposal of chlorinated water is the responsibility of the Contractor.

## SECTION 02511 - SITE WATER UTILITY DISTRIBUTION PIPING

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- b) The Contractor shall supply de-chlorinating agent conforming to AWWA C655. Where de-chlorinated water is to be disposed of in ditches or storm sewer, the Contractor shall have regard for fisheries concerns when selecting the de-chlorinating agent.
  - c) Water disposed of in ditches or storm sewers shall be de-chlorinated to meet the Provincial Surface Water Quality Guidelines and shall have a chlorine residual of less than 0.002 mg/L.
  - d) Water disposed of in sanitary sewers shall be de-chlorinated and shall have a chlorine residual of less than 0.1 mg/L.
  - e) The Contractor shall obtain approval from the City Engineering Department (759-5385) prior to disposal of dechlorinated water in the municipal storm or sanitary sewer systems. A copy of the approval shall be provided to the Contract Administrator.
  - f) De-chlorination shall be monitored by the Contract Administrator.
- .5 W.4. Temporary Water Services (OPSS 493)
- .1 493.04.01 Submission Requirements  
Clause 493.04.01 is amended by the addition of the following:  
The submitted plan will include:
    - i. a schedule;
    - ii. a list of affected properties including unit, apartment and suite numbers;
    - iii. plan drawing(s) showing planned service connection location(s), valves, hydrants and connections to supply;
    - iv. A list of spare parts to be kept on-site, for making repairs to the temporary water supply and means to ensure accessibility to PUC.The Contractor shall determine whether a hose bib is available at each building.
  - .2 Materials,  
General Clause 493.05.01 is amended according to the following:
    - a) Rigid pipe for temporary mains shall be minimum DR-17.
    - b) Temporary mains for potable water supply shall be a minimum 50mm diameter.
    - c) Temporary mains for fire protection or potable and fire protection shall be of a diameter specified in the Contract Documents.
    - d) All materials shall be capable of withstanding 1034 kPa pressure and all other conditions of use.
  - .3 493.05.02 Materials, Temporary Water Supply Services  
Clause 493.05.02 is amended by the addition of the following:
    - a) Any temporary pipe being re-used shall have been used exclusively for potable water.
    - b) Pipe missing caps and any re-used rigid pipe shall be cleaned, inspected and hand-swabbed with 1-5% sodium hypochlorite solution according to AWWA C651 prior to assembly.
    - c) All fittings shall be cleaned and disinfected with 1-5% sodium hypochlorite solution prior to assembly.
  - .4 493.07.01 Construction,  
General Clause 493.07.01 is amended by the addition of the following:
    - a) Connection to the private plumbing system of a residential unit shall be via a wye at an outside tap. The property owner is under no obligation to allow the temporary water system to be connected to their internal system at any location other than on the public side of the curb stop. If a hose bib is not available for outside connection, if access to the

## SECTION 02511 - SITE WATER UTILITY DISTRIBUTION PIPING

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meter cannot be provided, or in the event that a property owner will not permit an above ground connection as typical, it shall be the Contractor's responsibility to make alternate arrangements for temporary service to the property. Such arrangements shall be subject to the approval of the Contract Administrator. Connection at the curb stop may be required for apartments, commercial, institutional and industrial water customers as specified in the Contract Documents.

b) A vacuum breaker will be installed on the leg of the wye opposite the temporary connection to a hose bib.

c) All temporary water systems shall be properly protected and supported.

d) In the event of leakage or failure of a temporary potable water supply system, the Contractor shall advise the Contract Administrator and repair will be undertaken by PUC staff licensed under the Safe Drinking Water Act. PUC will invoice the contractor for time and materials required for the repairs. The Contractor shall not be entitled to additional payment for repairs of leakage or failure of temporary potable water systems.

e) Where a service interruption is unavoidable, the Contractor shall make every effort to minimize the length of the interruption. Such interruptions shall be kept to a maximum of 5 hours, and shall be between 9:00 am and 4:00 pm. Interruptions of greater than 8 hours shall require temporary servicing be in place. The Contract Administrator and PUC reserve the right to require this work be done at night to minimize inconvenience where large areas may have their water service interrupted for more than an 5 hours.

.5 493.07.02 Construction, Temporary Watermains

Clause 493.07.02 is amended by the addition of the following:

a) Double check valve assembly or Reduced Pressure type backflow preventers shall be installed at the point of supply to temporary water systems and shall be installed in accordance with the latest edition of CAN/CSA-B64.10 in a well-drained, tamper resistant enclosure with provisions for installation of a pad lock consistent with the contract documents. The backflow preventer will be maintained by PUC when the temporary service is in use.

b) Water supply for temporary systems shall be from an approved location in accordance with the contract documents. The source of supply shall be approved by the Contract Administrator.

c) Each branch of the temporary water system shall be fitted with one extra  $\frac{3}{4}$  service complete with curb stop, and DuC backflow preventer for the purpose of flushing temporary mains. Adequate drainage shall be provided for each to allow for continuous operation.

.6 493.07.03 Construction, Temporary Potable Water Supply Services

Clause 493.07.03 is amended by the addition of the following:

a) Temporary services shall be supplied with adapters as required to connect to hose bibs.

b) After the temporary system is placed in service, PUC will transfer those services to the temporary system identified in the contractor's plan for connection at the hose bib. PUC will remove the water meter, cap and tag the service at the meter for these addresses before connecting to the hosebib to prevent cross connection. The contractor shall be responsible for scheduling all transfers to be carried out by PUC, including access with property owners/occupants for all buildings serviced at the hose bib. Notice of such schedule shall be provided to PUC at least 48 hours in advance. PUC does not guarantee staff availability and accepts no responsibility for project delays as may be caused by lack of available staff. Service transfers at the curb stop shall be by the contractor and carried out under the supervision of the Contract Administrator.

c) Where a hose bib is not available for temporary service connections, and the contractor makes temporary connection to the existing service such as at the curb stop, the excavation shall be backfilled with sand. It is the intention to minimize open excavations for temporary water supplies.



## **SECTION 02511 - SITE WATER UTILITY DISTRIBUTION PIPING**

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- d) Services shall not be transferred to the temporary system at the curb stop until the new system has passed all testing in 493.07.08 as amended herein, and written direction has been issued by the Contract Administrator.
- .7 493.07.04 Construction, Temporary Hydrants  
Clause 493.07.04 is amended by the addition of the following:
- a) Subject to case-specific approval from the PUC and the Fire Department, one (1) municipal hydrant may be taken out of service at one time, such that there is not more than 300 meters between hydrants. In the event the hydrant spacing of 300 meters is exceeded, temporary hydrant(s) will be required in all cases. PUC will bag hydrants out of service.
- b) The Contractor shall be responsible for maintaining water supply for fire service at all buildings with private fire hydrants and or fire systems and shall be responsible for maintaining at such facilities. Private facilities shall not be taken out of service.
- c) Should buildings with fire private hydrants and/or suppression systems be serviced from temporary servicing, the supply pipe shall be sized to provide adequate flow, and the pipe shall be buried a minimum of 600mm to prevent heating.
- .8 493.07.06 Construction, Protection  
Clause 493.07.06 is amended by the addition of the following:
- The temporary watermains shall be installed behind the sidewalk and within the project excavation limits. Alternative locations shall be subject to the approval of the Contract Administrator. The Contractor shall be responsible for any restoration costs resulting from alternate locations of temporary mains and services without remuneration from the PUC or the City. No charges for additional restoration resulting from temporary systems will be allowed. Service piping shall be installed along the edge of existing driveways to avoid grass-cutting conflicts.
- .9 493.07.07 Construction, Leakage Testing  
Clause 493.07.07 is amended by the addition of the following:
- Leakage testing at system pressure shall be witnessed by PUC and the Contract Administrator. Leakage testing shall be made by visual observation of the entire temporary water system, charged to system pressure.
- The Contractor shall make a daily inspection of the temporary water system, recording the inspection in a log, deficiencies, and reporting the log on a daily basis to the contract administrator.
- .10 493.07.08 Construction, Flushing and Disinfecting Temporary Watermains and Services  
Clause 493.07.08 is amended by the addition of the following:
- a) Requirements of OPSS 441.07.25 as amended by PUC shall apply in addition to the requirements of this section.
- b) Routine chlorine sampling of in-service temporary watermains will be undertaken by a PUC Inc. Water Distribution Operator licensed under the Safe Drinking Water Act.
- .11 493.07.09 Construction, Removal of Temporary Water Supply Services  
Clause 493.07.09 is amended by the addition of the following:
- Temporary water systems shall be left in place until such time as the final connection of the new water works has been completed, including transferring of all services from the temporary system to the new system.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Sanitary sewerage drainage piping, fittings, accessories, and bedding.
- .2 Connection of building sanitary drainage system to on-site sewers.

**1.2 RELATED SECTIONS**

- .1 Section 31 05 13 - Soil Materials: Fill materials associated with pipe installation.
- .2 Section 31 05 16 - Aggregate Materials: Fill materials associated with pipe installation.
- .3 Section 31 23 16 - Excavating: Excavating subsoil for sewerage system piping.
- .4 Section 31 23 18 - Trenching: Backfilling over piping, granular pipe covering up to subgrade elevation.
- .5 Section 33 05 13 - Manholes And Catch Basins.
- .6 Section 33 44 00 - Storm Sewer Water Drains.

**1.3 REFERENCES**

- .1 AASHTO T 180-15 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
- .2 ASTM C76M-15 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- .3 ASTM C76-15a - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- .4 ASTM C443M-11 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- .5 ASTM C443-12 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- .6 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .7 ASTM D2321-14e1 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- .8 ASTM D2729-11 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .9 ASTM D3034-14a - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .10 ASTM D6938-15 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

**1.4 DEFINITIONS**

- .1 Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

**1.5 REGULATORY REQUIREMENTS**

- .1 Conform to applicable code for installation and materials of the Work of this section.

## **SECTION 02530 - SITE SANITARY SEWERAGE PIPING**

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### **PART 2 PRODUCTS**

#### **2.1 PIPE MATERIALS**

- .1 Reinforced Concrete Pipe and Joint Devices:
  - .1 Pipe: ASTM C76M or ASTM C76, Class III with Wall type C; mesh or bar reinforcement; inside nominal diameter as specified, bell and spigot end joints.
  - .2 Joint Device: ASTM C443M or ASTM C443, rubber compression gasket joint.
- .2 Plastic Pipe: PSP, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter as specified, bell and spigot style sealed joint end.
- .3 Plastic Pipe: ASTM D2729, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter as indicated, bell and spigot style solvent sealed joint end.
- .4 Plastic Pipe: ASTM D3034, Type PSM, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter as indicated, bell and spigot style solvent sealed joint end.

#### **2.2 PIPE ACCESSORIES**

- .1 Pipe Joints: integral bell and spigot with gasket.
- .2 Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, clean-outs, reducers, traps and other configurations required.

#### **2.3 BEDDING MATERIALS**

- .1 Aggregate Bedding: Fill Type as specified in Section 31 05 16.
- .2 Soil Bedding: Fill Type as specified in Section 31 05 13.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

#### **3.2 PREPARATION**

- .1 Hand trim excavations to required elevations. Correct over excavation with coarse aggregate or fine aggregate.
- .2 Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

#### **3.3 BEDDING**

- .1 Excavate pipe trench in as specified in Section 31 23 18 or 31 23 16 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- .2 Place bedding material at trench bottom as specified in Section 31 23 18 or 31 23 23, level materials in continuous layers not exceeding 200 mm compacted depth, compact to 95%.
- .3 Maintain moisture content of bedding material to plus or minus 2% to attain required compaction density.

## **SECTION 02530 - SITE SANITARY SEWERAGE PIPING**

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### **3.4 INSTALLATION - PIPE**

- .1 Install pipe, fittings, and accessories to manufacturer's written instructions. Seal joints watertight.
- .2 Lay pipe to slope gradients noted on Drawings; with maximum variation from true slope of 1:1000.
- .3 Install bedding at sides and over top of pipe to minimum compacted thickness as specified.
- .4 Refer to Section 31 23 18 for trenching requirements. Do not displace or damage pipe when compacting.
- .5 Refer to Section 33 05 13 for manhole requirements.
- .6 Connect to municipal sewer system or on-site sewer network.
- .7 Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer main or utility service or on-site sewer main, and trenching.

### **3.5 FIELD QUALITY CONTROL**

- .1 Section 01 45 00: Field testing or inspection.
- .2 Request inspection prior to and immediately after placing bedding.
- .3 Compaction testing will be performed to ASTM D698.
- .4 Moisture content testing will be performed to ASTM D1556/D1556M.
- .5 If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

### **3.6 PROTECTION OF FINISHED WORK**

- .1 Section 01 78 40: Protecting installed work.
- .2 Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame covers, anchorage, and accessories.

**1.2 RELATED SECTIONS**

- .1 Section 31 23 16 - Excavating:
- .2 Section 31 23 23 - Backfilling:

**1.3 REFERENCES**

- .1 ASTM A48/A48M-03(2012) - Standard Specification for Gray Iron Castings.
- .2 ASTM C55-14a - Standard Specification for Concrete Building Brick.
- .3 ASTM C62-13a - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
- .4 ASTM C478-15 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
- .5 ASTM C923-08(2013) - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
- .6 ASTM D3753-12e1 - Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells.
- .7 IMIAC (International Masonry Industry All-Weather Council) - Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

**1.4 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 9000 or ISO 14000 certification requirements.
- .2 Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

**1.5 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Maintain materials and surrounding air temperature to minimum 10 degrees C prior to, during, and forty-eight (48) hours after completion of masonry work.
  - .2 Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- .1 Manufacturer to be certified by the Ontario Concrete Pipe Association (OCPA) and a member of the OCPA's plant pre-qualification program.

## **SECTION 02631 - MANHOLES AND CATCHBASINS**

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### **2.2 MATERIALS**

- .1 Manhole Sections: Reinforced precast concrete as specified in MTO OPSD 700 series drawings and as specified on the drawings.

### **2.3 COMPONENTS**

- .1 Manhole Components: As specified in MTO OPSD 700 series drawings.

### **2.4 CONFIGURATION**

- .1 Shaft Construction: Concentric with eccentric cone top section or flat top; lipped male/female joints.
- .2 Shape: Cylindrical.
- .3 Clear Inside Dimensions: As indicated.
- .4 Design Depth: As indicated.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify items provided by other sections of Work are properly sized and located.
- .3 Verify that built-in items are in proper location, and ready for roughing into Work.
- .4 Verify excavation for manholes is correct.

### **3.2 PREPARATION**

- .1 Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

### **3.3 PLACING MANHOLE SECTIONS**

- .1 Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
- .2 Form and place manhole cylinder plumb and level, to correct dimensions and elevations.
- .3 Set cover frames and covers level without tipping, to correct elevations.
- .4 Coordinate with other sections of work to provide correct size, shape, and location.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Adjustments of existing manholes, catch basins.

**1.2 RELATED SECTIONS**

- .1 Section 33 05 13 – Manholes and Catch Basins.

**1.3 REFERENCES**

- .1 ASTM C139-14 - Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
- .2 CAN/CSA-A165 Series-04 (R2014) - Standards on Concrete Masonry Units.
- .3 CAN/CSA-A179-14 - Mortar and Grout for Unit Masonry.
- .4 CSA-A257 Series-14 - Standards for Concrete Pipe and Manhole Sections.
- .5 CSA-A3000-13 - Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

**1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Schedule work to maintain existing flow and minimize interruptions to existing services during construction.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Precast Manhole Section:
  - .1 MTO 700 series drawings.
  - .2 Top sections eccentric cone or flat slab top type with opening offset.
- .2 Precast Catch Basin Sections:
  - .1 MTO 700 series drawings.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify existing manholes, catch basins are ready to receive work of this section.

**3.2 MANHOLES AND CATCH BASINS**

- .1 Remove existing frame and cover. Identify and store for re-use at locations designated.
- .2 Adjust manhole barrel to required elevation by removing or installing precast concrete ring sections.
- .3 Set manhole frame and cover to required elevation using no more than three (3) concrete rings.

## **SECTION 02631.01 - ADJUSTMENTS OF MANHOLES AND CATCHBASINS**

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- .4 Recess catch basin frame and cover 10 mm below gutter elevation and 10 mm behind the face of curb.
- .5 Join brick course to frame with cement mortar, parge and make smooth and watertight.
- .6 Install additional ladder rungs in manholes as required.

**END OF SECTION**



## **SECTION 02701 - AGGREGATE MATERIALS**

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### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- .1 Aggregate materials.

#### **1.2 RELATED SECTIONS**

- .1 Section 31 05 13 - Soil Materials.
- .2 Section 31 22 13 - Rough Grading.
- .3 Section 31 22 19 - Finish Grading.
- .4 Section 31 23 18 - Trenching.
- .5 Section 31 23 23 - Backfilling.
- .6 Section 33 11 16 - Site Water Utility Distribution Piping.
- .7 Section 33 31 13 - Site Sanitary Sewerage Piping.
- .8 Section 32 11 23 - Aggregate Base Course.

#### **1.3 REFERENCES**

- .1 MTO OPSS 1004 – Material Specification for Aggregates - Miscellaneous
- .2 MTO OPSS 1010 – Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

#### **1.4 QUALITY ASSURANCE**

- .1 Perform Work in accordance with OPSS 1004 and OPSS 1010.

### **PART 2 PRODUCTS**

#### **2.1 COARSE AGGREGATE MATERIALS**

- .1 Coarse Aggregate Granular 'B': Conforming to MTO OPSS 1010.

#### **2.2 FINE AGGREGATE MATERIALS**

- .1 Fine Aggregate Type Granular 'A': Conforming to MTO OPSS 1010.

#### **2.3 SOURCE QUALITY CONTROL**

- .1 Aggregate Material - Testing and Analysis: Perform in accordance with LS-706 or ASTM D698.
- .2 If tests indicate materials do not meet specified requirements, change material or material source and retest.
- .3 Provide materials of each type from same source throughout the Work.

## **SECTION 02701 - AGGREGATE MATERIALS**

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### **PART 3 EXECUTION**

#### **3.1 STOCKPILING**

- .1 Stockpile materials on site at locations designated by Consultant.
- .2 Stockpile in sufficient quantities to meet Project schedule and requirements.
- .3 Separate differing materials with dividers or stockpile apart to prevent mixing.
- .4 Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

#### **3.2 STOCKPILE CLEANUP**

- .1 Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.
- .2 Leave unused materials in a neat, compact stockpile or remove from site as directed by Consultant.
- .3 If a borrow area is indicated, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Subsoil materials.
- .2 Topsoil materials.

**1.2 RELATED SECTIONS**

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 31 22 13 - Rough Grading.
- .3 Section 31 22 19 - Finish Grading.
- .4 Section 31 23 18 - Trenching.
- .5 Section 31 23 23 - Backfilling.
- .6 Section 32 92 20 - Seeding.

**1.3 REFERENCES**

- .1 MTO LS-706 Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg and a 305 mm Drop.
- .2 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .3 ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- .4 ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .5 ASTM D6938-15 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

**1.4 QUALITY ASSURANCE**

- .1 Perform Work in as directed by the Consultant.

**PART 2 PRODUCTS**

**2.1 SUBSOIL MATERIALS**

- .1 Subsoil Type: Native soils.

**2.2 TOPSOIL MATERIALS**

- .1 Topsoil
  - .1 Topsoil texture to consist of 20% to 70% sand and will have a minimum of 5% organic matter for clay loams and 2% organic matter for sandy loams to a maximum of 20% by volume.
  - .2 Topsoil will be free of subsoil, roots, grass, weeds, toxic materials, stones in excess of 25mm, and foreign objects.
  - .3 Topsoil will have an acidity range (pH) of 6.0 to 7.5.

## SECTION 02701.01 - SOIL MATERIALS

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- .4 Soil nutrients shall be present in the following ratios:
  - .1 Nitrogen (N): 20 – 40 micrograms of available N/ gram of topsoil
  - .2 Phosphorous (P): 10 – 20 micrograms of phosphate/ gram of topsoil
  - .3 Potassium (K): 80 – 120 micrograms of potash/ gram of topsoil
  - .4 Calcium, magnesium, and micro-nutrients including iron, zinc, boron, sulphur, copper, and molybdenum present in balanced ratios to support germination and establishment of intended vegetation.
- .2 Testing
  - .1 At the discretion of the Consultant, or if requested by the Contractor, prior to the use of any topsoil it shall be tested. The consultant shall have sampling and testing performed by an accredited testing laboratory for horticultural soil analysis on each source of topsoil supplied by the Contractor.
  - .2 The contractor shall supply the Consultant with samples of topsoil for inspection and testing at least two weeks prior to placement.
  - .3 No topsoil shall be placed until approved by the consultant.
  - .4 In the event that test results indicate the topsoil does not meet the specifications above and/ or is not suitable for its intended purpose, the Contractor, at his own expense, shall take the necessary remedial action(s) as recommended in the soil analysis report.
  - .5 Acceptance or rejection of the topsoil material will be at the consultant's discretion or based upon the soil analysis report, if performed. Rejected material must be removed from the site at the Contractor's expense.
- .3 Soil Amendments
  - .1 Apply and spread soil amendments at specified rate as recommended in soil analysis report.
  - .2 Mix soil amendment well into full depth of topsoil. Retest amended soil to confirm compliance with soil analysis report.
- .4 Placing
  - .1 Prior to placing topsoil, the sub-grade shall be graded to eliminate uneven areas and low spots ensuring positive drainage.
  - .2 All debris, branches or stones shall be removed.
  - .3 No topsoil shall be placed until the Consultant has inspected and approved the sub-grade condition.
  - .4 Care shall be taken when working around roots of live trees including hand excavation.
  - .5 The topsoil surface shall be compacted to 85% approximately Standard Proctor Maximum Dry Density (SPMDD).
  - .6 Placement shall be such that soil is smooth with a fine loose surface prior to laying sod or placing hydro-seed/ seeding.
  - .7 The topsoil shall be free of lumps, hollows, and deleterious materials.
  - .8 Topsoil depth shall be as shown on the drawings. A minimum depth, where not specified, shall be 75mm.

### 2.3 SOURCE QUALITY CONTROL

- .1 Section 01 43 00: Testing and analysis of soil material.
- .2 Testing and Analysis of Subsoil Material: Perform to LS-706 or ASTM D698.
- .3 Testing and Analysis of Topsoil Material: Perform to LS-706 or ASTM D698 for moisture density relationship.

## **SECTION 02701.01 - SOIL MATERIALS**

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- .4 Teste and Analysis of Topsoil Material: Perform to ASTM D5268 or equivalent for soil chemical and composition testing.
- .5 If tests indicate materials do not meet specified requirements, change material and retest.
- .6 Provide materials of each type from same source throughout the Work.

### **PART 3 EXECUTION**

#### **3.1 SOIL REMOVAL**

- .1 Remove lumped soil, boulders, and rock.
- .2 Stockpile excavated material in area designated on site and remove excess material not being used, from site.
- .3 Remove excess excavated material from site.

#### **3.2 STOCKPILING**

- .1 Stockpile materials on site at locations designated by Consultant.
- .2 Stockpile in sufficient quantities to meet Project schedule and requirements.
- .3 Separate differing materials with dividers or stockpile apart to prevent mixing.
- .4 Prevent intermixing of soil types or contamination.
- .5 Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

#### **3.3 STOCKPILE CLEANUP**

- .1 Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.
- .2 Leave unused materials in a neat, compact stockpile.
- .3 If a borrow area is indicated, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

**END OF SECTION**

## **SECTION 02721 - AGGREGATE BASE COURSE**

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### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- .1 Aggregate base course.

#### **1.2 RELATED SECTIONS**

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 31 22 13 - Rough Grading: Preparation of site for base course.
- .3 Section 31 22 19 - Finish Grading: Topsoil fill at areas adjacent to aggregate base course.
- .4 Section 31 23 18 - Trenching: Compacted fill under base course.
- .5 Section 31 23 23 - Backfilling: Compacted fill under base course.
- .6 Section 31 22 19 - Finish Grading
- .7 Section 32 12 16 - Asphalt Paving:
- .8 Section 33 05 13 - Manholes and Catch Basins:

#### **1.3 REFERENCES**

- .1 MTO LS-706 Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg and a 305 mm Drop.
- .2 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .3 ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- .4 ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .5 ASTM D6938-15 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

- .1 Coarse Aggregate Fill (Lower Courses): Granular 'A' - As specified in Section 31 05 16.
- .2 Fine Aggregate Fill (Upper Courses): Granular 'B' - As specified in Section 31 05 16.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify substrate has been inspected, gradients and elevations are correct, and is dry.

#### **3.2 PREPARATION**

- .1 Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- .2 Do not place fill on soft, muddy, or frozen surfaces.

## **SECTION 02721 - AGGREGATE BASE COURSE**

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### **3.3 AGGREGATE PLACEMENT**

- .1 Spread aggregate over prepared substrate to a total compacted thickness as specified.
- .2 Place aggregate in maximum 200 mm layers and compact to specified density.
- .3 Level and contour surfaces to elevations and gradients indicated.
- .4 Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- .5 Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- .6 Use mechanical tamping equipment in areas inaccessible to compaction equipment.

### **3.4 TOLERANCES**

- .1 Section 01 73 00: Tolerances.
- .2 Flatness: Maximum variation of 6 mm measured with 3 m straight edge.
- .3 Scheduled Compacted Thickness: Within 6 mm.
- .4 Variation From Design Elevation: Within 6 mm.

### **3.5 FIELD QUALITY CONTROL**

- .1 Compaction testing will be performed to MTO-706.
- .2 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- .3 Frequency of Tests: As specified by consultant.

### **3.6 SCHEDULES**

- .1 Compact placed aggregate materials to achieve compaction of 100% SPMDD.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Asphaltic concrete paving, wearing binder or base course.
- .2 Surface sealer.
- .3 Aggregate base course.

**1.2 RELATED SECTIONS**

- .1 Section 09 91 10 - Painting: Pavement markings.
- .2 Section 31 22 13 - Rough Grading: Preparation of site for paving [and base].
- .3 Section 31 23 23 - Backfilling: Compacted subbase for paving.
- .4 Section 32 11 23 - Aggregate Base Course.
- .5 Section 32 13 15 - Concrete Sidewalks, Curbs, and Gutters
- .6 Section 33 05 13 - Manholes and Catch Basins

**1.3 REFERENCES**

- .1 MTO OPSS 310 – Construction Specification for Hot Mix Asphalt

**1.4 QUALITY ASSURANCE**

- .1 Perform Work to ;Province of Ontario MTO standards.
- .2 Mixing Plant: Conform to Province of Ontario MTO standards.
- .3 Obtain materials from same source throughout.

**1.5 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Do not place asphalt when ambient air or base surface temperature is less than 4 degrees C, unless approved by the Consultant, or surface is wet or frozen.
  - .2 Place bitumen mixture when temperature is not more than 8 C degrees below bitumen suppliers bill of lading and not more than maximum specified temperature.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Asphalt Cement: ASTM D946/D946M.
- .2 Asphalt Cement: In accordance with Province of Ontario MTO standards.
- .3 Aggregate for Base Course Mix: As specified in MTO OPSS 1150.
- .4 Aggregate for Base Course Mix: In accordance with Province of Ontario MTO standards.
- .5 Aggregate for Binder Course Mix: As specified in MTO OPSS 1150.
- .6 Aggregate for Binder Course Mix: In accordance with Province of Ontario MTO standards.



## **SECTION 02741 - ASPHALT PAVING**

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- .7 Aggregate for Wearing Course Mix: As specified in MTO OPSS 1150.
- .8 Aggregate for Wearing Course Mix: In accordance with Province of Ontario MTO standards.
- .9 Fine Aggregate: As specified in Section 31 05 16, Type: Granular 'A'.
- .10 Fine Aggregate: In accordance with Province of Ontario MTO standards.
- .11 Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
- .12 Tack Coat: Homogeneous, medium curing, liquid asphalt or Emulsified asphalt.
- .13 Tack Coat: In accordance with Province of Ontario MTO standards.

### **2.2 ASPHALT PAVING MIX**

- .1 Use dry material to avoid foaming. Mix uniformly.
- .2 Base Course: In accordance with Province of Ontario MTO standards.
- .3 Binder Course: In accordance with Province of Ontario MTO standards.
- .4 Wearing Course: In accordance with Province of Ontario MTO standards.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify base conditions to Section 01 73 00.
- .3 Verify that compacted subgrade, granular base, or stabilized soil is dry and ready to support paving and imposed loads.
- .4 Verify gradients and elevations of base are correct.

### **3.2 SUBBASE**

- .1 Section 32 11 23: Aggregate base course forms the base construction for work of this section.

### **3.3 PREPARATION - TACK COAT**

- .1 Apply tack coat to manufacturer's written instructions.
- .2 Apply tack coat to Province of Ontario MTO standards.
- .3 Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1.75 L/sq m to 2.25 L/sq m.
- .4 Apply tack coat to contact surfaces of curbs, gutters, previously placed layers of asphalt.
- .5 Coat surfaces of manholes, catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

### **3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE**

- .1 Install Work in accordance with Province of Ontario MTO standards.
- .2 Place to thickness identified in drawings.
- .3 Install gutter drainage grilles and frames, manhole frames in correct position and elevation.

## **SECTION 02741 - ASPHALT PAVING**

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- .4 Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- .5 Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

### **3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE**

- .1 Place asphalt binder course within twelve 12 hours of applying primer or tack coat.
- .2 Place binder course to thickness identified in drawings.
- .3 Place wearing course within two 2 hours of placing and compacting binder course, or as soon as possible if paving on multiple days.
- .4 Place wearing course to thickness identified in drawings.
- .5 Install manhole frames, gutter drainage grilles and frames in correct position and elevation.
- .6 Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- .7 Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

### **3.6 TOLERANCES**

- .1 Section 01 73 00: Tolerances.
- .2 Flatness: Maximum variation of 6 mm measured with 3 m straight edge.
- .3 Scheduled Compacted Thickness: Within 6 mm.
- .4 Variation from True Elevation: Within 13 mm.

### **3.7 PROTECTION OF FINISHED WORK**

- .1 Section 01 78 40: Protecting installed work.
- .2 Immediately after placement, protect pavement from mechanical injury until surface temperature is less than 60 degrees C.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Painted pavement markings.
- .2 Reflective glass beads in paint.

**1.2 REFERENCES**

- .1 AASHTO M 247-13 - Standard Specification for Glass Beads Used in Traffic Paints.
- .2 AASHTO M 248-91 (2012) - Standard Specification for Ready-Mixed White and Yellow Traffic Paints.
- .3 MPI (Master Painters Institute) – Architectural Painting Specifications Manual and Maintenance Repainting Manual.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination:
  - .1 Coordinate with other work having a direct bearing on work of this section.
  - .2 Coordinate with installation of surrounding surfaces and signage and supports.

**1.4 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 9000 or ISO 14000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .3 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

**1.5 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Apply paint only when ambient temperature is above 10 degrees C and no rain is forecast, unless approved otherwise by Consultant.

**1.6 WARRANTY**

- .1 Provide a two (2) year warranty to include coverage for failure to meet specified requirements.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Paint: Alkyd traffic paint, to AASHTO M 248, MPI #97, latex, or MPI #32, alkyd.
  - .1 Colours: Yellow, White, and Blue as specified on drawings.
- .2 Thinner: Petroleum spirits, low flash.
- .3 Glass beads: Overlay type to AASHTO M 247.

## **SECTION 02761 - PAINTED PAVEMENT MARKINGS**

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### **2.2 EQUIPMENT REQUIREMENTS**

- .1 Paint Applicator:
  - .1 Pressure distributor.
  - .2 Capable of applying paint in single and dashed lines.
  - .3 Ensure uniform application.
  - .4 Equip with positive shut-off.
- .2 Apply reflective glass beads as an overlay on freshly applied paint.

### **PART 3 EXECUTION**

#### **3.1 PREPARATION**

- .1 Assure pavement surface free of surface water, snow, frost, ice, dust, gravel, oil, and other foreign materials.
- .2 Provide adequate warning signs and traffic devices to prevent fresh-paint tracking by traffic.

#### **3.2 APPLICATION**

- .1 Lay out pavement markings prior to applying paint, to approval of Consultant.
- .2 Apply traffic paint evenly at rate of 3 sq m/L.
- .3 Do not thin paint unless approved by Consultant.
- .4 Symbols and letters to conform to dimensions indicated.
- .5 Paint lines of uniform colour and density with clean edges.
- .6 Thoroughly clean distributor tank before refilling with paint of different colour.
- .7 Apply glass beads at a rate of 200 g/sq m on:
  - .1 Painted area on road centrelines.
  - .2 Other areas designated.
  - .3 Immediately after application of paint.

#### **3.3 TOLERANCES**

- .1 Section 01 73 00: Tolerances.
- .2 Painted Markings:
  - .1 Maximum Variation from Required Line Width Dimensions: Plus or minus 6 mm.
  - .2 Maximum Variation from Required Length Dimensions: Plus or minus 13 mm.
  - .3 Remove Incorrect Markings.

#### **3.4 CLEANING**

- .1 Remove all debris, rubbish, and excess material.

#### **3.5 PROTECTION OF FINISHED WORK**

- .1 Protect pavement markings from any disfigurement, until dry.

**SECTION 02761 - PAINTED PAVEMENT MARKINGS**

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**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Formed and reinforced concrete sidewalks, street side curbs and gutters.
- .2 Paraplegic ramps.

**1.2 RELATED SECTIONS**

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 30 00 - Cast-in-Place Concrete.
- .4 Section 31 23 16 - Excavating.
- .5 Section 31 23 23 - Backfilling.

**1.3 REFERENCES**

- .1 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 CSA-A23.1-09/A23.2-14 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Granular Base: Sections 31 23 16 and 31 23 23 for excavating, fill and compaction.
- .2 Forms: Section 03 11 00.
- .3 Reinforcement: Section 03 20 00.
- .4 Concrete Mix and Materials: Section 03 30 00.
- .5 Curing Compound: Section 03 30 00.
- .6 Joint filler: Section 03 30 00.
- .7 Form Release Agent: Non-staining mineral type, chemically active containing compounds that react to provide a water soluble soap for ease of release.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- .1 Construct embankments using excavated material free from organic matter or other objectionable materials.
- .2 Dispose of surplus or unsuitable excavated material at a location off site as required.
- .3 Place fill in maximum 200 mm layers, compact to 95% of optimum density to ASTM D698.
- .4 Obtain Consultant approval of subgrade before placing granular base.

## **SECTION 02770 - CONCRETE SIDEWALKS, CURBS AND GUTTERS**

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- .5 Place granular base material to lines, widths, and depths as indicated.
- .6 Compact base to 100% of optimum density.

### **3.2 CONCRETE PLACEMENT**

- .1 Perform concrete work to Section 03 30 00.
- .2 Immediately after rough floating, provide uniform broom finish to produce regular surface texture not exceeding 1.5 mm deep, by drawing broom in direction normal to centre line.
- .3 Provide edging as indicated with 10 mm radius edging tool.
- .4 Slip-form and, or form concrete with string line for line and grade control.
- .5 Hand finish surfaces when directed by Consultant.

### **3.3 TOLERANCES**

- .1 Section 01 73 00: Tolerances.
- .2 Finish surfaces flat to within 3 mm in 1 m as measured with straightedge placed on surface.

### **3.4 JOINTS**

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff but still plastic, at intervals of 1.2 m.
- .2 Place lateral expansion joints at intervals of 9 m.
- .3 Place isolation joints around manhole rings, catch basins, and adjacent to concrete curbs, catch basins, buildings, or permanent abutting surfaces.
  - .1 Install joint filler in isolation joints to Section 03 30 00 or as indicated.
  - .2 Seal isolation joints with sealant approved by Consultant.
- .4 When sidewalk is adjacent to curb or gutter, form joints of curb, gutter, and sidewalk to coincide.

### **3.5 CURING**

- .1 Cure concrete by adding moisture continuously to CSA-A23.1/A23.2, to exposed finished surfaces for minimum one (1) day after placing, or by sealing moisture by a surface curing compound approved by Consultant.
- .2 Apply curing compound evenly to form continuous film to compound manufacturer's requirements.

### **3.6 PARAPLEGIC RAMPS**

- .1 Remove existing curbs, gutters or sidewalks as necessary to construct paraplegic ramp.
- .2 Removals to begin and end at existing joints only. No saw cuts in existing work is permitted.
- .3 Construct concrete paraplegic ramps to lines and grades and slope gradients as indicated.
- .4 Hand finish ramp surfaces when and where directed.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Final grade topsoil for finish landscaping.

**1.2 RELATED SECTIONS**

- .1 Section 31 05 13 - Soil Materials.
- .2 Section 31 22 13 - Rough Grading: Site contouring.
- .3 Section 31 23 18 - Trenching: Backfilling trenches.
- .4 Section 31 23 23 - Backfilling: Backfilling at building areas.
- .5 Section 32 12 16 - Asphalt Paving.
- .6 Section 32 92 20 - Seeding: Finish ground cover.

**PART 2 PRODUCTS**

**2.1 MATERIAL**

- .1 Topsoil: as specified in Section 31 05 13.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify building and trench backfilling have been inspected.
- .3 Verify substrate base has been contoured and compacted.

**3.2 SUBSTRATE PREPARATION**

- .1 Eliminate uneven areas and low spots.
- .2 Remove debris, roots, branches, stones, in excess of 25 mm in size. Remove subsoil contaminated with petroleum products.
- .3 Scarify surface to depth of 150 mm where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

**3.3 PLACING TOPSOIL**

- .1 Place topsoil in areas where planting, sodding, and, or seeding is required to thickness as specified (to a minimum depth, where not specified, of 75 mm. Place topsoil during dry weather.
- .2 Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- .3 Remove roots, weeds, rocks, and foreign material while spreading.
- .4 Manually spread topsoil close to plant life and, or building to prevent damage.
- .5 Lightly compact placed topsoil.



## **SECTION 02911 - FINISH GRADING**

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- .6 Remove surplus subsoil and topsoil from site.
- .7 Leave stockpile area and site clean and raked, ready to receive landscaping.

### **3.4 TOLERANCES**

- .1 Section 01 73 00: Tolerances.
- .2 Top of Topsoil: Plus or minus 13 mm.

### **3.5 PROTECTION OF FINISHED WORK**

- .1 Protect landscaping and other features remaining as final work.
- .2 Protect existing structures, fences, sidewalks, utilities, paving, curbs.

### **3.6 SCHEDULES**

- .1 Seeded Grass: 100 mm.
- .2 Sod: 100 mm.
- .3 Shrub Beds: 300 mm.
- .4 Flower Beds: 300 mm.
- .5 Planter Boxes: To within 75 mm of box rim.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Preparation of subsoil.
- .2 Placing topsoil.
- .3 Seeding, Hydroseeding, mulching, and fertilizing.
- .4 Maintenance.

**1.2 RELATED SECTIONS**

- .1 Section 31 05 13 - Soil Materials: Topsoil material.
- .2 Section 31 22 19 - Finish Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
- .3 Section 31 23 18 - Trenching: Rough grading over cut.
- .4 Section 31 23 23 - Backfilling: Rough grading of site.

**1.3 DEFINITIONS**

- .1 Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

**1.4 QUALITY ASSURANCE**

- .1 Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

**1.5 REGULATORY REQUIREMENTS**

- .1 Comply with regulatory agencies for fertilizer and herbicide composition.
- .2 Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

**1.6 DELIVERY, STORAGE, AND PROTECTION**

- .1 Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- .2 Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

**PART 2 PRODUCTS**

**2.1 SEED MIXTURE**

- .1 Seed Mixture shall meet the requirements of the Seed Act for Canada, Certified No. 1.
- .2 Seed shall have a minimum germination rate of 85%.
- .3 Seed shall have a minimum purity of 97%.

**2.2 SOIL MATERIALS**

- .1 Topsoil: As specified in Section 31 05 13
- .2 Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots.

**2.3 ACCESSORIES**

- .1 Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- .2 Mulching Material: Hemlock species wood cellulose fibre, chip form, free of growth or germination inhibiting ingredients.
- .3 Fertilizer: Type recommended for soil and grass, with 50% of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil as indicated in analysis
- .4 Fertilizer: Type recommended for soil and grass, with 50% of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil to the following proportions: nitrogen 16%, phosphoric acid 25%, soluble potash 12%.
- .5 Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.
- .6 Erosion Fabric: as specified in drawings. To be installed in accordance to manufacturer's specifications.
- .7 Stakes: Softwood lumber, chisel pointed.
- .8 String: Inorganic fibre.

**2.4 SOURCE QUALITY CONTROL**

- .1 Provide mix formulation for hydroseeding.
- .2 Analyse fertilizer to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

**2.5 EXAMINATION**

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that prepared soil base is ready to receive the work of this section.

**2.6 PREPARATION OF SUBSOIL**

- .1 Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- .2 Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
- .3 Scarify subsoil to a depth of 75 mm where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

**2.7 PLACING TOPSOIL**

- .1 Spread topsoil as specified (minimum depth of 75 mm where not specified) over area to be seeded. Rake until smooth.
- .2 Place topsoil during dry weather and on dry unfrozen subgrade.
- .3 Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- .4 Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

- .5 Install edging at periphery of seeded areas in straight lines to consistent depth.
- .6 Coordinate with installation of underground sprinkler system piping and watering heads.

**2.8 FERTILIZING**

- .1 Apply fertilizer in accordance with manufacturer's written instructions.
- .2 Apply after smooth raking of topsoil.
- .3 Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- .4 Mix thoroughly into upper 50 mm of topsoil.
- .5 Lightly water to aid the dissipation of fertilizer.

**2.9 SEEDING**

- .1 Apply seed at a rate as recommended by supplier evenly in two intersecting directions. Rake in lightly.
- .2 Do not seed areas in excess of that which can be mulched on same day.
- .3 Planting Season: April to September.
- .4 Do not sow immediately following rain, when ground is too dry, or during windy periods.
- .5 Roll seeded area with roller not exceeding 50 kg.
- .6 Immediately following seeding and compacting, apply mulch to a thickness of 3 mm. Maintain clear of shrubs and trees.
- .7 Apply water with a fine spray immediately after each area has been mulched. Saturate to 100 mm of soil.

**2.10 HYDROSEEDING**

- .1 Apply seeded slurry with a hydraulic seeder at a rate as recommended by seed supplier evenly in two intersecting directions.
- .2 Do not hydro-seed area in excess of that which can be mulched on same day.
- .3 Immediately following seeding, apply mulch to a thickness of 3 mm. Maintain clear of shrubs and trees.
- .4 Apply water with a fine spray immediately after each area has been mulched. Saturate to 100 mm of soil.

**2.11 SEED PROTECTION**

- .1 Identify seeded areas with stakes and string around area periphery.
- .2 Cover seeded slopes with erosion fabric as directed on drawings. Roll fabric onto slopes without stretching or pulling.
- .3 Lay fabric smoothly on surface, bury top end of each section in 150 mm deep excavated topsoil trench. Provide 300 mm overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- .4 Secure outside edges and overlaps at 900 mm intervals with stakes.
- .5 Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- .6 At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 150 mm.

**2.12 MAINTENANCE**

- .1 Mow grass at regular intervals to maintain at a maximum height of 65 mm. Do not cut more than 1/3 of grass blade at any one mowing.
- .2 Neatly trim edges and hand clip where necessary.
- .3 Immediately remove clippings after mowing and trimming.
- .4 Water to prevent grass and soil from drying out.
- .5 Roll surface to remove minor depressions or irregularities.
- .6 Control growth of weeds. Apply herbicides in accordance with manufacturer's written instructions. Remedy damage resulting from improper use of herbicides.
- .7 Immediately reseed areas which show bare spots.
- .8 Protect seeded areas with warning signs during maintenance period.

**END OF SECTION**

## **SECTION 04060 - MORTAR**

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### **PART 1 - GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Comply with requirements of Division 1.

#### **1.2 RELATED WORK**

- .1 Concrete fill for block lintels and reinforced masonry: Section 03300
- .2 Masonry, including mortar joint workmanship: Section 04200

#### **1.3 QUALITY ASSURANCE**

- .1 Quality Standards: meet requirements of CSA A179-04.
- .2 Source of Material: for mortar to remain exposed in finished project, brands of cementitious materials and source of supply of sand, shall remain the same for duration of work.
- .3 Refer to Section 04200 for requirements of grout used in reinforced masonry.

#### **1.4 PRODUCT HANDLING**

- .1 Store cementitious materials so as to prevent moisture absorption from any source. Do not use material affected by moisture.
- .2 Store mortar aggregate materials to prevent contamination. Do not use contaminated materials.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- .1 Water: potable and non-staining.
- .2 Sand: CSA A82-56-M1976.
- .3 Portland cement: CSA-A5-03, Type 10.
- .4 Masonry cement: CSA-A8-03, Type H.
- .5 Lime: ASTM C207, Type S.
- .6 Colour pigment: Iron Oxide Pigment Harcros "F" Series (4 lb – 6% loading) by Elements (416-251-1161) or type recommended by mortar manufacturer. Up to 3 colours selected by Consultant.
- .7 Water repellent admixture: "Dry Block" by W.R. Grace.

### **PART 3 - EXECUTION**

#### **3.1 PROPORTIONING AND MIXING**

- .1 Mix mortar in accordance with CSA A179-04 except as specified herein.
- .2 Place an experienced and competent person in direct charge of mixing operations.
- .3 Accurately proportion and thoroughly mix mortar and grout in mechanical mixers.
- .4 Except where specified otherwise do not add admixtures of any kind to mixes.
- .5 All mortar shall be mixed for a period of not less than 3 minutes and not more than 10 minutes.
- .6 For exterior masonry use: 1:1:6 Portland cement/ lime/ mortar only.

## **SECTION 04060 - MORTAR**

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- .7 Provide silo mix mortar for all mortar required, by one of the following:
  - .1 Maxi-Mix
  - .2 Jiffy
  - .3 Forwells
  - .4 King Products
- .8 Mix coloured mortar in colour selected by Consultant, in accordance with pigment manufacturer's recommendations. Make adjustments in colour mix as directed by Consultant.

### **3.2 TIME LIMITS AND RETEMPERING**

- .1 Use and place mortar in final position within following time limits after mixing:
  - .1 Air Temp. above 26.5°C - 2 hours.
  - .2 Air Temp. below 26.5°C - 2.5 hours.
- .2 Standard mortar that has stiffened within above time limits because of evaporation of water may be retempered by adding water as frequently as needed to restore required consistency. Discard mortar not used within above time limits.
- .3 Do not retemper coloured mortar. Discard coloured mortar not used within time limits specified.

### **3.3 MORTAR SCHEDULE**

- .1 At foundations walls and solid bearing courses: type S mortar having a compressive strength of 15 Mpa.
- .2 For bedding steel bearing plates, lintels, for laying bearing courses under concentrated loads and for laying masonry below grade: Use Type 'M' cement mortar having a compressive strength of 17.5 Mpa minimum.
- .2 Bearing walls and interior wythe of exterior walls: type S mortar.
- .3 Exterior wythe of exterior walls and non-bearing interior partitions: type N mortar.
- .4 Provide coloured mortar at clay brick and architectural block locations.

**END**

## SECTION 04200 - MASONRY

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Supply of reinforcing steel and concrete for block lintels and reinforced masonry: Division 3
- .2 Mortar: Section 04060
- .3 Supply of loose steel lintels: Sections 05120 & 05500
- .4 Exterior wall steel stud framing, including masonry ties: Section 05410
- .5 Lateral support members for non-loadbearing partitions: Section 05500
- .6 Cavity wall insulation: Section 07200
- .7 Sheet membrane air barrier: Section 07270
- .8 Firestopping and smoke seals: Section 07840
- .9 Caulking of control & expansion joints: Section 07900
- .10 Supply of steel door frames: Section 08110

#### 1.3 WORK INSTALLED BUT SUPPLIED BY OTHERS

- .1 Build into masonry elements inserts, anchors, bolts, sleeves and other items supplied by other Sections and which are required for installation and performance of work of other Sections.
- .2 Install loose steel lintels required for support of masonry elements.
- .3 Install steel door frames and access doors occurring in masonry elements.
- .4 Install reinforcing steel and concrete fill into block lintels.
- .5 Install precast concrete sills and copings.

#### 1.4 QUALITY ASSURANCE

- .1 Meet requirements of CSA A370-04, CSA A371-04 and CSA S304.1-04.
- .2 Ensure that work is executed under the continuous supervision and direction of a competent foreperson.
- .3 Comply with requirements of Section 01410 when constructing fire rated walls and partitions. Solidly fill around beams and joists penetrating fire rated walls/ partitions in accord with requirements of Ontario Building Code.
- .4 Masonry units used in partitions / walls designated to provide a fire separation shall be of thickness and material required to achieve required rating. Hollow masonry units used in fire separation shall have the necessary percentage of solid material to meet required rating. Concrete block used in fire separation shall be suitably identified to permit verification of fire resistance rating.

#### 1.5 SUBMITTALS

- .1 Submit samples of each type masonry accessory required, including but not limited to horizontal reinforcing, ties, weep hole inserts, dampproof coursing, mortar dropping control device.



## **SECTION 04200 - MASONRY**

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- .2 Submit drawings showing proposed locations of control joints to Consultant for review.

### **1.6 SITE MOCK-UPS**

- .1 Construct minimum 600 x 600 mm brick masonry sample panel to determine acceptability of each mortar colour. Make adjustment to mortar colour as directed by Consultant and repeat procedure until each mortar colour is approved.
- .2 Construct sample panel of a cavity wall including reinforcement, insulation, air barrier, flashings and weep holes, minimum 1.6 m x 2.5 m in size. Include each type of exterior veneer. Build sample panel in stepped-back fashion to expose each material used (brick/block, insulation, air barrier, block) to a minimum height of 400 mm each. Coordinate with Sections 07200 and 07270 for installation of air barrier and insulation.
- .3 Construct sample panel of interior concrete block partition, including wall corner and door opening, approximately 3 m long x full height.
- .4 Do not begin masonry work until panel is approved by Consultant. Approved panel shall represent minimum standard of quality for project masonry.

### **1.7 PRODUCT HANDLING & STORAGE**

- .1 Deliver and handle masonry units so as to prevent soiling and chipping.
- .2 Store masonry units above and off ground on level platforms which permit air circulation under stacks.
- .3 During storage, protect masonry units against moisture absorption, damage and staining.

### **1.8 PROTECTION**

- .1 When work is not in progress, cover tops of completed masonry elements exposed to weather with non-staining weatherproof covers. Covers shall be at least 600 mm wider than masonry elements and shall be well secured against displacement.
- .2 Protect finished work at corners, sills, projections and other areas likely to be damaged, with suitable coverings until completion of building.
- .3 Adequately brace masonry walls and partitions to resist effects of wind and other lateral forces.

### **1.9 HOT AND COLD WEATHER WORK**

- .1 When outside temperature is below or likely to go below 5°C provide heat to maintain temperature of materials and surrounding air at 5°C or better during laying and for 72 hours thereafter. Submit for approval the proposed method of protecting masonry against low temperatures. Salamanders will not be permitted.
- .2 Keep units completely free from ice and frost. Preheat mortar materials and mortar boards. Temperature of mortar to be between 21°C and 48°C. Protect mortar from frost. Do not use admixtures or antifreezes in mortar.
- .3 Maintain dry beds for masonry and use dry masonry units only. Do not wet masonry units in winter.
- .4 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

## SECTION 04200 - MASONRY

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### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- .1 Exterior Brick:
  - .1 reuse salvaged brick.
- .2 Interior Concrete Block:
  - .1 To requirements of CSA A165 Series-04; unless otherwise indicated:
    - .1 masonry: H/15/A/M.
  - .2 Units must be cured for at least 28 days before delivery and shall have a moisture content of not more than 30% of total absorption.
  - .3 Exposed concrete block units shall be uniform in size, free of perceptible warp or twist, without chipped, ragged or broken edges; have a uniform surface texture, free of cracks, blemishes or defects detrimental to appearance or performance.
  - .4 Provide special concrete block units as indicated and as follows:
    - .1 Lintel block
    - .2 Bullnose block
    - .3 Solid block
- .3 Metal Reinforcement and Anchors:
  - .1 Material: high tensile strength steel wire meeting ASTM A82, by Blok-Lok or Dur-O-Wall.
  - .2 Horizontal reinforcement:
    - .1 Steel wire, cold drawn high tensile strength, to ASTM A82, with hot dip galvanized finish after fabrication to ASTM A153, Class B2.
    - .2 Steel wire, cold drawn high tensile strength to ASTM A82, with mill galvanized finish to ASTM A116, Class 3.
    - .3 Stainless steel wire: Type 302.
    - .4 Horizontal reinforcement, interior walls. Truss type with 3.6 mm diameter mill galvanized steel side and cross rods; side rods centred on concrete block face shells; prefabricated assemblies at corners and intersections: BLOK-TRUS BL30 by Blok-Lok or equivalent product by Dur-O-Wal.
  - .3 Connectors, anchors and ties:
    - .1 Materials:
      - .1 Steel: hot dip galvanized to ASTM A123 and stainless steel Type 302.
      - .2 Wire materials: as specified for metal reinforcement.
    - .2 Interior masonry to concrete: 2.5 mm galvanized anchor and 4.8 mm diameter galvanized steel wire tie with galvanized steel dovetail anchor slots: Dovetail Anchors BLT8 by Blok-Lok.
    - .3 Interior masonry to structural steel: 4.8 mm diameter galvanized triangular wire tie with galvanized steel adjustable anchors: Flex-O-Lok BLT9 and Adjustable Flex-O-Lok Anchors by Blok-Lok.
- .4 Mortar for load-bearing masonry: Type S.

**PART 3 - EXECUTION****3.1 ERECTION - GENERAL**

- .1 Lay masonry work in uniform manner. No one portion of any section of work shall rise more than 750 mm above general level. Do not lay more than 1500 mm in height of any wall in any working day.
- .2 Unless otherwise noted, all walls and partitions shall extend to the underside of the structural deck.
- .3 Cut exposed masonry units with power driven table model masonry saw only. Ragged or chipped edges will not be permitted.
- .4 Consult with other Sections to avoid cutting and patching. Co-operate in setting and aligning built-in items. Build in conduit and piping so that they are not exposed. Do not break masonry bond to accommodate concealed built-in items.
- .5 Grout solid with mortar all spaces around built-in items.
- .6 Build in metal nailing plugs, grounds, inserts, anchor bolts, bearing plates, loose and miscellaneous items of steel and iron, isolated beams, lintels and shelf angles, sleeves, blocking and items furnished by other Sections.
- .7 Do not shift or tap masonry units after mortar has taken its initial set.
- .8 At masonry openings less than 450 mm wide, unless otherwise detailed, use mild steel plates, minimum 6 mm thick, of width 25 mm less than supported masonry thickness and with minimum 100 mm end bearing each side.
- .9 Construct structurally reinforced masonry elements in accordance with requirements indicated on structural drawings.

**3.2 CHASES, OPENINGS AND HOLES**

- .1 Chases and openings shall be built in during erection of masonry work, and purpose-made chased units shall be built into proper position.
- .2 Openings in masonry work exceeding 450 mm shall be provided with lintels in accord with lintel schedule.
- .3 Chasing of completed walls or formation of holes shall only be carried out with Consultant's prior approval, and then only with a tool designed to cleanly cut masonry units.
- .4 Chases shall be plumb and shall be minimum of one unit length from jambs of openings.
- .5 No horizontal or diagonal chases will be permitted.

**3.3 MASONRY BEARING**

- .1 Masonry bearing shall extend full thickness of wall.
- .2 Unless otherwise indicated, provide at least 200 mm of bearing for lintels and beams.
- .3 Bearings of block masonry walls: use minimum 2 courses of solid or grouted block units except where concrete bearing pads are required.
- .4 Bearings in brick masonry walls: use solid face brick where exposed to view.
- .5 Build masonry neatly around beam, and lintel bearings.

**3.4 CONSTRUCTION JOINTS**

## SECTION 04200 - MASONRY

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- .1 Where fresh masonry joins partially or totally set masonry, clean exposed surfaces of set masonry and remove loose mortar and foreign material prior to laying fresh masonry.
- .2 If necessary to stop off a horizontal run of masonry, rack back one-half masonry unit length in each course. Tothing will not be permitted unless approved by the Consultant.

### 3.5 BLOCKWORK

- .1 Interior blockwork shall be laid up in running bond except where shown otherwise. Unless otherwise indicated, blocks shall be of thickness required to produce total wythe thickness.
- .2 Do not wet blocks before laying.
- .3 Units shall be laid with webs aligning one over the other in full bed of mortar over entire laying surface including webs.
- .4 Exposed faces shall be full units laid out to minimize cutting with not less than 100 mm any at vertical edge or corner.
- .5 Top course of block walls shall be laid with solid blocks at door and window sills, at wall changes to brick and where shown.
- .6 Use solid block for at least two courses under all point bearing loads.
- .7 Provide bullnose block at all exposed block corners, except where directed by Consultant.
- .8 Provide minimum 400 mm solid or grouted block for jambs of openings and at ends of walls.
- .9 Cut with power saw exposed units to accommodate flush mounted electrical outlets, grilles and other components. Leave maximum 5 mm clearance. Cover plates and flanges must cover cut edges.
- .10 Blockwork scheduled to be left exposed or painted shall be laid and pointed with utmost care. Distribute units of varying colour and texture evenly to achieve homogeneous blend. Replace at no extra cost to Contract, block units which in the opinion of the Consultant are too contrasting in appearance for satisfactory blending.
- .11 Take special care to prevent mortar or other substances from staining exposed block faces. Replace stained blocks as directed by the Consultant at no extra cost to Contract.

### 3.6 BLOCK LINTELS

- .1 Build block lintels; install reinforcement and concrete fill. Unless otherwise detailed make lintels 200 mm high.
- .2 Lintels shall have minimum 200 mm bearing, with care taken in layout of wall to ensure that lintel jointing coincides with regular bond of wall.
- .3 Provide building paper in joint at bearings and at vehicle joint at ends of block lintels to break bond.

### 3.7 JOINT WORK

- .1 Make joints uniform and 10 mm thick unless otherwise shown.
- .2 All joints including joints in walls above ceilings and areas behind wall mounted and built-in fixtures, shall be tooled when thumbprint hard with a 25 mm o.d. plastic tool to produce a concave joint.
- .3 Joints in unparged masonry below grade shall be pointed tight with a trowel.
- .4 Joints directly behind resilient base, rigid insulation, ceramic tile and gypsum board shall be struck flush.

## **SECTION 04200 - MASONRY**

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### **3.8 ANCHORING, BONDING & REINFORCEMENT**

- .1 Anchor or bond walls and partitions at points where they intersect.
- .2 Except where stack bond is required bond each wythe or masonry walls and partitions at corners by alternately bonding 50% of units of each wall and partition at corner intersection.
- .3 Bond non-loadbearing walls and partitions to loadbearing walls with ties spaced at 400 mm o.c. vertically. Provide one tie for each 100 mm thickness, or part thereof, of wall or partition.
- .4 Anchor masonry walls and partitions to concrete and steel elements with anchors spaced at 400 mm vertically.
- .5 Unless otherwise indicated reinforce all walls and partitions with continuous horizontal metal reinforcement, installed at 400 mm o.c. vertically.
- .6 At wall openings place continuous reinforcement in first and second mortar joints above and below openings. Additional reinforcement at openings shall extend 610 mm beyond both sides of openings.
- .7 Install prefabricated corner assemblies at corners.
- .8 Lap continuous reinforcement 150 mm at splices. Cut reinforcement at control joints.
- .9 Tie brick veneer to exterior wall steel studs and to concrete block back-up in accordance with requirements of CSA A370-04.

### **3.9 STEEL DOOR FRAMES**

- .1 Install steel frames in masonry walls. Build in frames rigid, true and plumb. Fill voids between frames and masonry with mortar grout. Fill fixed door centre mullions with grout.
- .2 Brace frames solidly in position while being built in. Provide temporary horizontal wood spreader at mid-height of frames to ensure maintenance of required frame width until masonry work is completed. For frames over 1200 mm width provide temporary vertical support at centre of head.
- .3 Comply with installation requirements specified under Section 08110.

### **3.10 MISCELLANEOUS**

- .1 Where non-loadbearing, non-fire rated partitions extend to underside of structural deck, terminate partitions as detailed. Where not detailed allow for structural deflection and fill space with premoulded joint filler. Refer to Section 07840 for firestopping requirements at fire rated partitions. Recess joint filler to permit installation of caulking by Section 07920.
- .2 Provide continuous 0.1 mm thick polyethylene or glass fibre reinforced kraft paper - asphalt laminate bond breaker at base of partitions and walls which bear on concrete slabs.
- .3 Provide paper backed galvanized steel lath as required for support of grout and mortar fill within masonry elements.
- .4 Build in date stone and document box in location indicated (after Project completion at a date determined by Owner).

### **3.11 PATCHING AND CLEANING**

- .1 At completion of work, holes and other defects in masonry joints shall be repaired, and masonry surfaces shall be thoroughly cleaned.
- .2 Holes in masonry joints shall be filled with mortar and suitably tooled. Cut out and repoint defective joints. Use coloured mortar to match existing.

## **SECTION 04200 - MASONRY**

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- .3 Dry brush masonry surfaces at end of each day's work and after all final pointing.
- .4 Remove mortar smears and droppings from concrete block masonry surfaces after such smears and droppings have dried. When mortar joints are dry and hard, clean block masonry surfaces by rubbing down with abrasive blocks and stiff fibre brushes.
- .5 Remove mortar particles from clay masonry surfaces with wood paddles. Remove stains from clay masonry surfaces by wet cleaning in accordance with manufacturer's recommendations.
- .6 Upon completion of work, clean blockwork by brushing and washing. In extreme cases a 5% solution of muriatic acid may be used preceded and followed by a copious bath of clean water. Clean blockwork to be painted to suit requirements of Section 09900.

**END**

## **SECTION 05500 - METAL FABRICATIONS**

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### **PART 1 - GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Comply with requirements of Division 1.

#### **1.2 RELATED WORK**

- .1 Structural steel: Section 05120
- .2 Painting: Section 09900

#### **1.3 WORK SUPPLIED BUT NOT INSTALLED**

- .1 Supply following items for installation under other Sections of work: anchor bolts, bearing plates, sleeves and other inserts to be built into concrete and masonry elements and required for anchorage and support of metal fabrications.
- .2 Supply other Sections with instructions, and if required, templates, necessary for accurate setting of inserts and components.

#### **1.4 QUALITY ASSURANCE**

- .1 Qualifications of Welders: certified under CSA W47.1-03 for appropriate class of work.
- .2 Upon completion of installation of ladders, stairs, platforms, pit covers, balustrades and railings submit certification by professional engineer responsible for design of these components, verifying that they have been installed in accordance with reviewed shop drawings.
- .3 Sizes of structural members, such as stair stringers shall be taken to be a minimum size and shall not be decreased without Consultant's approval.

#### **1.5 SHOP DRAWINGS**

- .1 Submit detailed shop drawings of all metal fabrications required, showing profiles, members, fastenings, thicknesses, finishes and other pertinent data.
- .2 Shop drawings for stairs, balustrades, railings, platforms, pit covers and ladders shall bear stamp of a professional engineer registered in Ontario.

#### **1.6 PRODUCT HANDLING**

- .1 Deliver, handle and store fabricated components to prevent permanent distortion, corrosion and damage.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- .1 Steel sections and plate: CAN/CSA-G40.21-M04, Grade 300W.
- .2 Square steel tube: CAN/CSA-G40.21-M04, Grade 350W.
- .3 Steel pipe: ASTM A53, Type E, Grade A.
- .4 Sheet steel: hot dip galvanized, cold rolled, with stretcher level degree of flatness to ASTM A653; zinc coating designation Z275.
- .5 Wire mesh: hot dip galvanized woven mesh: wire cloth ½" square opening, .092 wire diameter.
- .6 Steel gratings: hot dip galvanized, welded or pressure locked steel gratings, unless otherwise shown type 19-4 by Dominion Bridge, Borden or other manufacturer approved by Consultant; stair treads with checkered nosings.

## SECTION 05500 - METAL FABRICATIONS

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- .7 Stainless steel: ASTM A167 and ASTM A269, Type 302 or 304, finish selected by Consultant; where no finish is indicated include for No. 4 finish.
- .8 Perforated stainless steel plate: 3.5 mm thick with 4.8 mm round openings at 6.3 mm o.c. (50% open) by Unalloy.
- .9 Welding materials: CSA W59-M1989.
- .10 Shop primer: CAN/CGSB-1.40-M89.
- .11 Zinc rich shop paint:
  - .1 Shop coat: Inorganic reinforced zinc rich paint: Devoe Catha-Coat 302..
  - .2 Field touch up: CAN/CGSB 1.181-02.
- .12 Bituminous enamel: alkali resistant asphaltic coating.
- .13 Non-shrink grout: Por-Rok by Hallemite Products Ltd., or SET 15 Minute Anchoring Cement by SET Products Ltd., or equivalent product by CPD Products.
- .14 Casters for chair dollies: 125 mm diameter x 35 mm tread width, hard rubber swivel wheel with ball bearings; 136 kg capacity: Darnell 60 Series Model 16-65-XH.

### 2.2 FABRICATION - GENERAL

- .1 Fabricate components in the shop in largest size practicable to minimize field jointing.
- .2 Fabricate components square, straight, true, free from warpage and other defects. Accurately cut, machine file and fit joints, corners, copes and mitres.
- .3 Reinforce fabricated components to safely withstand expected loads.
- .4 Make joints in built-up sections with hairline joints in least conspicuous locations and manner.
- .5 Make allowance for thermal expansion and contraction when fabricating exterior work.
- .6 Joints shall be welded unless otherwise indicated and unless details of construction do not permit welding. Exposed welds shall be continuous and shall be ground smooth.
- .7 Close exposed open ends of tubular members with welded on steel plugs.
- .8 Where work of other Sections is to be attached to work of this Section, prepare work by drilling and tapping holes, as required to facilitate installation of such other work.
- .9 Work of this Section, supplied for installation under other Sections, shall be prepared as required ready for installation by: drilling, countersinking and tapping holes, forming shapes and cutting to required sizes.
- .10 Grind off mill stampings and fill recessed markings on steel components left exposed to view.
- .11 Follow recommendations of AISI Committee of Stainless Steel Producers when fabricating, joining, welding, and finishing stainless steel components. Remove heat discolourations with mechanical, chemical or electrochemical means. Provide temporary protective coverings for all stainless steel components.

### 2.3 FINISHES

- .1 Thoroughly clean steel of loose scale, rust, oil, dirt and other foreign matter. Suitably prepare steel surfaces by power tool cleaning to receive specified finishes.
- .2 Grind smooth sharp projections.



## **SECTION 05500 - METAL FABRICATIONS**

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- .3 Remove oil and grease by solvent cleaning.
- .4 Apply coatings in the shop and before assembly. Where size permits, galvanize components after assembly.
- .5 Shop apply coat of primer to interior components after fabrication except where stainless steel, galvanized or zinc rich paint finish is required.
- .6 Exterior components except where required to be hot dip galvanized: blast clean metals to "Near White Grade" (SSPC-SP-10) and spray apply a coat of zinc rich paint maximum 3 mils thick.
- .7 Hot dip galvanize (unpassivated) components where so indicated after fabrication in accordance with requirements of CAN/CSA-G164-M92, minimum coating weight 600 g/m<sup>2</sup>.
- .8 Apply coat of bituminous enamel to contact surfaces of metal components in contact with cementitious materials and dissimilar metals.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install components plumb, square, straight and true to line. Drill, cut and fit as necessary to attach this work to adjoining work.
- .2 Provide temporary supports and bracing required to position components until they are permanently anchored in place.
- .3 Securely anchor components in place; unless otherwise indicated, anchor components as follows:
  - .1 To concrete and solid masonry with expansion type anchor bolts.
  - .2 To hollow construction with toggle bolts.
  - .3 To thin metal with screws or bolts.
  - .4 To thick metal with bolts or by welding.
  - .5 To wood with bolts or lag screws.
  - .6 Fill space between railing members and sleeves with non-shrink grout.
- .4 Install trench drain in accordance with manufacturer's instructions. Coordinate with Division 15 for drain connection.
- .5 Provide all components required for anchoring. Make anchoring in concealed manner wherever possible. Make exposed fastenings, where approved by Consultant, neatly and of same material, colour, texture and finish as base metal on which they occur. Keep exposed fastenings evenly spaced.
- .6 Dissimilar metals and metals in contact with cementitious elements shall have contact surfaces coated with bituminous paint or be isolated by other means as approved by Consultant.
- .7 After installation, clean and refinish injured finishes, welds, bolt heads and nuts. Refinish with zinc rich paint or primer to match original finish.
- .8 Upon completion of work, or when directed by Consultant, remove protective coverings from stainless steel components.

#### **3.3 SCHEDULE**

- .1 Provide all metal fabrications required whether listed hereunder or not, unless clearly covered by another Section.
- .2 Unless otherwise shown provide:

## **SECTION 05500 - METAL FABRICATIONS**

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- .1 Interior components: prime coated steel
  - .2 Exterior components: zinc rich paint coated steel.
- .3 List of components:
- .1 Loose lintels, plates, angles and other members required but not shown on structural drawings.
  - .2 Other metal fabrications required.

**END**

## **SECTION 06100 - ROUGH CARPENTRY**

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### **PART 1 - GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Comply with requirements of Division 1.

#### **1.2 RELATED WORK**

- .1 Concrete formwork: Section 03300
- .2 Finish carpentry: Section 06200
- .3 Cabinetwork: Section 06410

#### **1.3 QUALITY ASSURANCE**

- .1 Lumber shall bear the grading stamp of an agency certified by The Canadian Lumber Standards Administration Board.
- .2 All lumber shall be sound, straight, dressed all sides and kiln dried, and moisture content at any time during shipment and storage shall not exceed 19%.

#### **1.4 WORK SUPPLIED BUT NOT INSTALLED**

- .1 Supply to other Sections anchors, bolts, rough hardware and other items required to be built into work of other Sections to receive, accommodate, secure work of this Section.
- .2 Provide other Sections with instructions to ensure accurate setting of built-in items.

#### **1.5 PRODUCT HANDLING**

- .1 Store materials on site to prevent deterioration, loss or impairment of their structural and other essential properties. Prevent excessive moisture gain of materials.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- .1 Lumber:
  - .1 Meet requirements of CAN/CSA-086-01 Strength Group D (spruce-pine-fir) and CAN/CSA 0141-05 and National Lumber Grading Authority (NLGA) Standard Grading Rules.
  - .2 Blocking, Copings, Nailers, Curbs: NLGA 122c "Standard" S-P-F.
- .2 Plywood:
  - .1 All locations except backboards: Douglas Fir to CSA 0121-M1978 Unsanded Sheathing Grade.
  - .2 Backboards: Softwood Douglas Fir to CSA 0151-04, Sanded grade, solid two sides, fire retardant pressure treated.
- .3 Fasteners and Connecting Hardware:
  - .1 Nails: to CSA B111-1974, hot dip galvanized steel for exterior work including components located in exterior walls and roofs; bright finish steel in all other locations. Unless otherwise indicated use common spiral flathead nails.
  - .2 Bolts, nuts, washers: ASTM A307, hot dip galvanized steel.
  - .3 Connectors, anchors, brackets, spikes: hot dip galvanized structural quality steel.

## SECTION 06100 - ROUGH CARPENTRY

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- .4 Screws: to CSA B35.4-1972 zinc, cadmium or chrome plated.
- .4 Air Barrier:
  - .1 Tyvek Commercial, woven fabric
- .5 Wood Siding:
  - .1 Factory coated lap siding, LP Canexel "Ridgewood D-5"  
regular installation system, textured finish, solid colour factory applied finish, colour to later selection.

### 2.2 WOOD TREATMENT

- .1 Preservative pressure treated components: to CSA 080 Series-97 arsenic free, containing copper and azole.
- .2 Fire retardant pressure treated components: to CSA 080- M1983 for maximum flame spread of 25 and labelled by ULC.
- .3 Surface cut, bore and trim components to sizes required as much as possible prior to pressure treatment.

## PART 3 - EXECUTION

### 3.1 GENERAL

- .1 Erect work plumb, level, square and to required lines. Ensure that materials are rigidly and securely attached to each other and to adjacent building elements and will not be loosened by work of other Sections.
- .2 Where other materials and components are to be applied directly over wood members recess heads of fastening devices below wood surfaces.
- .3 Where work remains exposed to view, fasteners shall be uniformly and evenly spaced and neatly installed.

### 3.2 NAILERS, BLOCKING, COPINGS, GROUNDS, CURBS

- .1 Provide wood nailers, blocking, copings, strapping, bucks, grounds and other rough carpentry components to sizes and in locations required for satisfactory support of fabricated items and other work. Provide wood blocking at steel stud framed gypsum board partitions for support of wall mounted components.
- .2 Unless otherwise indicated, provide minimum 38 mm thick materials. Grounds may be 21 mm thick material unless otherwise indicated.
- .3 Provide built-up wood curbs for rooftop mounted equipment. Unless otherwise detailed, provide 90 mm thick curbs extending minimum 300 mm from top of roof membrane to top of curb.
- .4 Provide minimum 12 mm thick plywood back-up for fastening of curtain tracks and blinds at head of windows, where curtains or blinds are required.

### 3.3 ANCHORS AND FASTENERS

- .1 Provide rough hardware including nails, screws, bolts, washers, brackets, hangers, and fastening devices of all types.
- .2 Unless otherwise indicated, attach wood members at maximum 600 mm o.c. as follows:
  - .1 To concrete and solid masonry with expansion or friction type anchor bolts.

## **SECTION 06100 - ROUGH CARPENTRY**

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- .2 To hollow masonry with toggle bolts.
  - .3 To heavy gauge metal with bolts.
  - .4 To light gauge metal with screws or bolts.
  - .5 To wood with nails, screws or bolts as required to ensure stability.
- .3 Bucks and plates shall be anchored to masonry walls with 13 mm galvanized steel bolts or with approved type screw anchors.
  - .4 Fasten wood copings to supporting masonry elements with 13 mm galvanized steel bolts minimum 450 mm long spaced maximum 600 mm o.c. Where width of coping plate exceeds 100 mm, stagger bolts off centre.

### **3.4 BACKBOARDS**

- .1 Where required by Division 16 and by telephone system supplier, provide minimum 19 mm thick plywood backboards mounted on strapping if required.
- .2 Size backboards to adequately accommodate equipment to be mounted. Secure boards with countersunk fasteners to supporting walls in manner which will carry equipment load without damaging wall.

### **3.5 PRESSURE TREATED COMPONENTS**

- .1 Use preservative pressure treated lumber and plywood within exterior wall and roof systems and at other locations indicated.
- .2 Where it is necessary to cut, bore or otherwise alter pressure treated components in the field, treat cut surfaces with heavy coat of wood preservative.
- .3 Use fire retardant pressure treated plywood at backboards and where plywood is installed on steel stud framed walls, behind gypsum board and where parapets extend beyond 600 mm.

**END**

## SECTION 06200 - FINISH CARPENTRY

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Metal support brackets: Section 05500
- .2 Rough carpentry: Section 06100
- .3 Cabinetwork: Section 06410
- .4 Supply of finish hardware: Section 08710
- .5 Painting: Section 09900

#### 1.3 QUALITY ASSURANCE

- .1 Reference Standards: unless otherwise specified, carry out finish carpentry work in accordance with requirements of "Architectural Woodwork Quality Standards " (latest issue) of Architectural Woodwork Institute (AWI) and Architectural Woodwork Manufacturer's Association of Canada (AWMAC).

#### 1.4 SUBMITTALS

- .1 Submit two samples of each type of solid wood and plywood used in exposed work scheduled to receive transparent finish.

#### 1.5 PRODUCT DELIVERY, HANDLING & STORAGE

- .1 Protect against damage, including damage by excessive changes in moisture content, during delivery and storage. Maintain minimum storage temperature of 16°C, and relative humidity 25% to 55%.
- .2 Do not deliver finish carpentry components to site before all wet trades are completed, the building is closed in and humidity conditions on site are acceptable. Do not deliver during rain or damp weather.
- .3 Store materials on site in such a way as to prevent deterioration or loss or impairment of essential properties. Prevent moisture gain of kiln dried materials.

#### 1.6 PROTECTION

- .1 Provide coverings as necessary to protect finish carpentry components from damage of any kind during storage and after installation.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- .1 Solid Wood:
  - .1 Unless otherwise indicated, provide AWI/AWMAC Premium Grade.
  - .2 All wood materials shall be new, straight and clean, free of sap, knots, pitch, and other defects, except as permitted by applicable grading rules.
  - .3 All wood shall be kiln dried to a maximum moisture content of 12% for exterior work and 6% to 8% for interior work.
  - .4 Hardwood: Species as indicated; where no species is indicated, provide Maple.

## SECTION 06200 - FINISH CARPENTRY

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- .5 Softwood: to CAN/CSA 0141-05, dressed all sides used in concealed locations only except where shown otherwise. Unless otherwise indicated use No. 1 White Pine at interior locations.
- .2 Panel Materials:
  - .1 Composite wood and agrifiber products shall contain no added urea-formaldehyde resin. Adhesives used to fabricate laminated assemblies containing these products shall contain no urea-formaldehyde.
  - .2 Hardwood plywood: to CSA 0115-M1982, Type II Veneer: AWMAC Architectural Grade Maple or Select White Birch.
  - .3 Softwood plywood: to CSA 0151-04, Sanded Grade, Solid Two Sides. Use in concealed locations only.
  - .4 Particleboard: to ANSI A208.1, density 700 kg/m<sup>3</sup>.
- .3 Fasteners and Adhesives:
  - .1 Nails and staples: CSA B111-1974, galvanized.
  - .2 Screws: zinc, cadmium or chrome plated steel.
  - .3 Adhesive: waterproof type.

### 2.2 FABRICATION

- .1 General Requirements:
  - .1 Exposed joints and edges:
    - .1 Uniformly space exposed joints unless otherwise indicated.
    - .2 Edge grain shall not be visible; mitre external corners, house internal corners. Secure corners with corrugated metal fasteners. Glue mitred corners.
    - .3 All exposed edges of plywood and particle board shall have solid wood edging, pressure glued.
  - .2 Mechanical fasteners:
    - .1 Inconspicuously locate mechanical fasteners. Wherever possible conceal fastenings.
    - .2 Countersink nail heads.
    - .3 Unless otherwise indicated, countersink screw and bolt heads and fill holes with matching wood plugs.
  - .3 Cutting and fitting: make cutouts in work of this Section as required to accommodate work of other Sections.
- .2 Standing & Running Trim:
  - .1 Fabricate trim and base of softwood where paint finish is designated and of hardwood where transparent finish is required.
  - .2 Length: standing trim shall be in one piece. Running trim shall be in longest practicable lengths.
  - .3 Thickness: unless otherwise indicated, minimum 13 mm.

## **SECTION 06200 - FINISH CARPENTRY**

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- .3 Rails, Slats, Caps, Base:
  - .1 Fabricate components to profiles shown and in longest practicable lengths.
  - .2 Slightly round exposed edges, sand smooth all surfaces.
  - .3 Unless otherwise indicated fabricate members of hard- wood. Use the same species of wood throughout, except where specifically indicated otherwise.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install finish carpentry components plumb, true and level and securely fasten in place. Accurately scribe and closely fit components to irregularities of adjacent surfaces.
- .2 Accurately fit joints in true plane, locate joints over bearing or supporting surfaces.
- .3 Provide mechanical fastening devices such as nails, screws and bolts required for fastening wood components. Unless permitted provide concealed fastening of components.
- .4 Where permitted, nail with small headed finishing nails. Countersink nail heads with nail setter.
- .5 Where components are fastened with screws or bolts, countersink screw and bolt heads and provide wood plugs matching surrounding wood.
- .6 Install caps, rails, base, casings and trim in longest practicable lengths; accumulation of short pieces not permitted. No edge grain shall be visible; mitre corners. Slope cut intermediate joints.
- .7 Provide interior wood trim where indicated and where required to complete work.
- .8 Select components within any area to produce well blended, uniform appearance. Avoid use of components with starkly contrasting colours. Replace components which in Consultant's opinion are not of satisfactory appearance.

#### **3.2 FINISHING**

- .1 Sand finished wood surfaces thoroughly as required to produce uniformly smooth surface, always sanding in direction of grain run. Coarse grained sandpaper marks, hammer marks, or other similar imperfections in finished work are not acceptable.

#### **3.3 SCHEDULE**

- .1 Unless specifically indicated otherwise, all finish carpentry components shall receive transparent stain and varnish finish by Section 09900.
  - .2 Provide the following:
    - .1 Window sills
    - .2 closet shelves
    - .3 Wood trim (Maple)
    - .4 Other finish carpentry components required.

**END**



## SECTION 06410 - CABINETWORK

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Metal fabrications: Section 05500
- .2 Rough carpentry: Section 06100
- .3 Finish carpentry: Section 06200
- .4 Glass and glazing: Section 08800
- .5 Sinks, faucets: Division 15
- .6 Electrical outlets: Division 16

#### 1.3 DEFINITION

- .1 "Exposed" when referred to in this Section shall mean all parts that can be viewed and shall include interiors of cupboards, cabinets and counters, backs of doors, shelving, gables, drawers.

#### 1.4 QUALITY ASSURANCE

- .1 Reference Standards: unless otherwise specified, carry out finish carpentry work in accordance with requirements of "Architectural Woodwork Quality Standards" (latest issue) of Architectural Woodwork Institute (AWI) and Architectural Woodwork Manufacturers' Association of Canada (AWMAC), Custom Grade.

#### 1.5 SUBMITTALS

- .1 Submit detailed shop drawings for cabinetwork showing proposed assembly, connections, anchorage, materials, dimensions, thickness and finishes.
- .2 Shop drawings shall be originated and produced by fabricator and may not be copied or reproduced from Consultant's drawings. Each item shall be shown in plan, section and elevation, detailed in appropriate scale, clearly displaying all required information. Single line diagrams are not acceptable.
- .3 Submit duplicate samples of each type of solid wood and plywood used in exposed work prior to fabrication of cabinetwork.

#### 1.6 PRODUCT DELIVERY, HANDLING & STORAGE

- .1 Protect cabinetwork against damage, including damage by excessive changes in moisture content. Maintain minimum storage temperature of 16°C, and relative humidity 25% to 55%.
- .2 Cover plastic laminate faces at shop with heavy Kraft paper.
- .3 Do not deliver finish carpentry components to site before all wet trades are completed, the building is closed in and humidity conditions on site are acceptable. Do not deliver during rain or damp weather.
- .4 From time of fabrication until installation, store handle and transport materials so as to prevent deterioration or loss or impairment of essential properties. Prevent moisture gain of kiln dried materials.

## **SECTION 06410 - CABINETWORK**

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### **1.7 PROTECTION**

- .1 Provide coverings as necessary to protect finish carpentry components from damage of any kind during storage and after installation.

### **1.8 WARRANTY**

- .1 At no cost to Owner remedy any defects in work of this Section due to defects in materials and workmanship, including but not necessarily limited to delamination, warping, and other defects detrimental to appearance and/or performance for a period of 2 years from date of Substantial Performance.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Cabinetry:
  - .1 Public Spaces: Solid Hardwood, Maple Premium Grade.
  - .2 Apartment Units: Plastic Laminated Particleboard. Colour as selected by Consultant.
- .2 Solid Wood:
  - .1 Unless otherwise indicated, provide AWMAC Premium Grade.
  - .2 All wood materials shall be new, straight and clean, free of sap, knots, pitch, and other defects, except as permitted by applicable grading rules.
  - .3 All wood shall be kiln dried to a maximum moisture content of 6% to 8%.
  - .4 Hardwood: Maple Premium Grade.
  - .5 Softwood: to CAN/CSA-0141-05, dressed all sides used in concealed locations only except where shown otherwise. Concealed framing: No. 1 Grade White Pine.
- .3 Panel Materials:
  - .1 Composite wood and agrifiber products shall contain no added urea-formaldehyde resin. Adhesives used to fabricate laminated assemblies containing these products shall contain no urea formaldehyde.
  - .2 Hardwood plywood: to CSA 0115-1982, Type II, veneer: AWI/AWMAC AA Grade Select Maple.
  - .3 Softwood plywood: to CSA 0151-04, Sanded Grade, solid two sides. Use in concealed locations only.
  - .4 Particleboard: ANSI A208.1, 700 kg/m<sup>3</sup> density.
- .4 Plastic Laminated Components:
  - .1 Plastic laminate facing sheet: ANSI/NEMW LD3-2005, Grades HGS and VGS; colours, gloss and texture will be selected by Consultant from full range of products by Formica, Arborite, Nevamar, Pionite and Wilsonart.
  - .2 Backing sheet: BK Grade by manufacturer of facing sheet.
  - .3 Core: particleboard.
  - .4 Laminating adhesive: CAN3-0112 Series M1977, urea formaldehyde free.
  - .5 Core sealer: clear water resistant synthetic resin sealer.

## SECTION 06410 - CABINETWORK

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- .5 Fasteners & Adhesive:
  - .1 Nails and staples: CSA B111-1974, galvanized.
  - .2 Screws: zinc, cadmium or chrome plated steel.
  - .3 Adhesive: CAN3-0112 Series - M1977, waterproof type.
- .6 Cabinet Hardware: products listed below are a standard of acceptance. Products by other manufacturers, of equal quality and similar appearance may also be provided subject to review and approval by Consultant.
  - .1 Hinges for 19 mm door Blum 91-650, 170° with self-closing spring.
  - .2 Hinges for 35 mm thick doors: Hager 1279 76 x 76.
  - .3 Door and drawer pull: GSH 302 x 100 mm, CTC 7.5 mm o.d. brushed stainless steel.
  - .4 Drawer slides: KV 1429 full extension for 45 kg load @ 500 mm.
  - .5 Drawer locks: Olympus 078 or National Cabinet Lock C8702 or Corbin CCL 02066, keyed as directed by Consultant.
  - .6 Cabinet locks: Olympus 078 or National Cabinet Lock C8702 or Corbin CCL 02067, keyed as directed by Consultant.
  - .7 Pilaster and clips: KV 255, 256.
  - .8 Coat hooks: GSH 307 x 115 mm brushed stainless steel.
  - .9 Coat rod: GSH 138-2, 32 mm x 2 mm wall thickness chrome plated.
  - .10 Hardware finish: Unless otherwise indicated chrome or nickel plated.
  - .11 Heavy Duty Brackets:
    - Vanities: Hafele 267.45.425
    - Other areas: Hafele 267.45.868

### 2.2 FABRICATION

- .1 General Requirements:
  - .1 Exposed surfaces:
    - .1 Provide wood members free from bruises, blemishes, mineral marks, knots, shakes and other defects, except as specifically permitted by grade rules.
    - .2 Select exposed surfaces in any one area for balanced overall appearance free of stark contrasts.
    - .3 Sand smooth all exposed surfaces to provide even and uniform finish free of defects detrimental to appearance.
  - .2 Exposed joints and edges:
    - .1 Uniformly space exposed joints unless otherwise indicated.
    - .2 No edge grain shall be visible; mitre external corners, house internal corners. Secure corners with corrugated metal fasteners. Glue mitred corners.

## SECTION 06410 - CABINETWORK

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- .3 All exposed edges of plywood and particle board shall have solid wood edging, pressure glued.
- .3 Mechanical fasteners:
  - .1 Inconspicuously locate mechanical fasteners. Wherever possible conceal fastenings.
  - .2 Countersink nail heads.
  - .3 Where exposed to view, countersink screw and bolt heads and fill holes with matching wood plugs.
- .4 Cutting and fitting: make cutouts in work of this Section as required to accommodate work of other Sections.
- .2 Standing & Running Trim:
  - .1 Fabricate trim of hardwood.
  - .2 Length: standing trim shall be in one piece. Running trim shall be in longest practicable lengths.
  - .3 Thickness: unless otherwise indicated, minimum 6 mm.
- .3 Plastic Laminate Components:
  - .1 Unless otherwise specified herein meet requirements of AWI/AWMAC "Quality Standards".
  - .2 Assembly: bond plastic laminate to core with adhesive using pressure. Bond plastic laminate to both faces of core using same adhesive and same pressure.
  - .3 Core: unless otherwise indicated: 19 mm thick plywood or particleboard.
  - .4 Balanced construction: plastic laminate covered components shall be of balanced construction, with plastic laminate on both faces of core. Seal core edges not covered with plastic laminate.
  - .5 Use largest practicable plastic laminate sheet size.
  - .6 Provide joints symmetrically; provide joints at corners and at changes in superficial areas; provide concealed draw bolt anchors at joints. All butt joints shall have a blind spline.
  - .7 Construct countertops with preformed front edge and square corner splashback. Chamfer edges uniformly at approximately 20°C; do not mitre.
  - .8 At L-shaped corners mitre plastic laminate to outside corner. Accurately fit members together to provide tight and flush butt joint.
  - .9 Apply self-edged minimum 1.1 mm thick plastic laminate to exposed ends of countertops.
  - .10 Construct splashbacks minimum 100 mm high or higher where indicated. Return splashback at ends except where indicated otherwise.
  - .11 Openings and cutouts:
    - .1 Radius internal corners at least 3 mm and chamfer edges.
    - .2 Where core edge is to remain exposed, cover with plastic laminate edging.
    - .3 Where core edge is to be concealed, seal with sealer.
- .4 Cabinetwork:

## SECTION 06410 - CABINETWORK

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- .1 As far as practicable, assemble work in shop and deliver to site ready for installation. Leave ample allowance for fitting and scribing in place.
- .2 Except where otherwise detailed use "flush overlaid" construction. Where shown or required use "exposed case" construction. Tenon, dado, dowel or rabbet interior construction with all parts well glued along full length/height. Use glue blocks where necessary. Shoulder mitre all exposed corners. Open ends or skeleton frames against walls are not permitted.
- .3 Construct all cabinetwork, counters, cupboards, including tops, bottoms, backs and shelves from hardwood faced veneer core plywood or solid hardwood. Use same species of hardwood throughout, unless a specific species is called up, shown or specified for a particular unit or area. Select hardwood plywood for each cabinetwork unit so as to produce well blended uniform appearance. Avoid use of starkly contrasting veneer colours within any one unit. Replace components which in Consultant's opinion are not of satisfactory appearance.
- .4 Design and fabricate work to accommodate expansion and contraction of components. All connectors and fasteners shall be concealed unless permitted by Consultant to be exposed. Fabricate work to produce tight joints. Locate prominent joints where directed. Prevent opening up of joints and glue lines in finished work.
- .5 Unless otherwise indicated provide the following thicknesses:
  - .1 Doors: 16 mm
  - .2 Drawer fronts: 16 mm
  - .3 Gables: 19 mm
  - .4 Cabinet backs (floor supported): 12 mm
  - .5 Cabinet backs (wall hung): 19 mm
  - .6 Shelves: 19 mm
  - .7 Drawer bodies: 12 mm
- .6 Rout gables for pilaster strips where adjustable shelving is required.
- .7 Construct shelving of hardwood faced veneer plywood. Reinforce shelves where span exceeds 1000 mm.
- .8 Construct doors and drawer fronts of 19 mm hardwood faced plywood.
- .9 Provide running members in maximum length obtainable. Provide thickness of members in maximum dressed size of standard lumber. Where width or thickness indicated is not available, use glue laminations to obtain sizes required.
- .10 Install cabinet hardware in accordance with hardware manufacturer's directions. Unless otherwise indicated, provide each drawer and door with pull, each drawer with extension hardware and each door with minimum two hinges, (2 hinges for door height up to 900 mm, 3 hinges for door height up to 1350 mm and 4 hinges for door height up to 1800 mm). Provide locks at all doors and drawers unless otherwise shown.
- .11 Unless otherwise indicated, factory finish all cabinetwork with a stain and polymerizing two component catalytic conversion varnish system; colour and sheen to be selected by Consultant. All surfaces shall be carefully prepared and sanded before and between coats to provide final finish which shall be smooth, even and uniform free of machine marks, hammer marks, depressions and imperfections.
- .12 Apply moisture repellent sealer to concealed backs of cabinetwork.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

## **SECTION 06410 - CABINETWORK**

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- .1 Install cabinetwork components plumb, true and level and securely fasten in place. Accurately scribe and closely fit components to irregularities of adjacent surfaces.
- .2 Accurately fit joints in true plane, locate joints over bearing or supporting surfaces.
- .3 Provide mechanical fastening devices such as nails, screws and bolts required for fastening wood components. Unless permitted provide concealed fastening of components.
- .4 Where permitted, nail with small headed finishing nails. Countersink nail heads with nail setter.
- .5 Install plastic laminate components using concealed fastening devices.
- .6 Where components are fastened with screws or bolts, countersink screw and bolt heads and provide wood plugs matching surrounding wood.
- .7 Where cabinetwork abuts other building elements provide wood trim matching cabinetwork except where otherwise detailed.
- .8 Prepare work of this Section to receive services, fittings and fixtures provided by Division 15 and 16.
- .9 Where access is required to valves and other mechanical and electrical components, located behind cabinetwork, provide removable plywood access panels of size required and secure with four brass screws.
- .10 Install display case cork and liner in accordance with manufacturer's recommendations. Bond to substrates with adhesive free of bubbles and tears, with joints neat and tight and with exposed surfaces free of adhesive and stains.
- .11 Check operation of all movable parts and, if necessary, adjust to ensure proper and smooth function.
- .12 Upon completion of installation, inspect work of this Section and touch up, where required, minor or damaged surface finish to restore it to original condition. Replace damaged components which, in the opinion of the Consultant, cannot be satisfactorily repaired.

**END**

**1 GENERAL****1.1 GENERAL REQUIREMENTS**

1.1.1 Conform to Sections of Division 1, as applicable.

**1.2 DESCRIPTION**

1.2.1 Work shall include the supply and installation of plastic faced architectural casework and related components in Rooms/Units 301, 304, 305, 306, 307, 401, 402, 405, and 406 including, but not limited to the following:

- (a) plastic faced casework as specified herein and shown on the Drawings, and
- (b) countertops and backsplashes.

**1.3 REFERENCED STANDARDS**

|       |  |  |
|-------|--|--|
| 1.3.1 | ANSI 135.4<br>ANSI A161.2-98<br><br>ANSI A208.1-16<br>ANSI/NEMA LD 3-05<br>AWI<br>BHMA A156.9-15<br>CAN3-A172-M79 (R1996)<br>CAN3-O188.1-M78<br>CAN/CGSB-11.3-M87<br>CSA B111-1974<br>CAN/CSA G164-M92<br>CSA O112 Series-M1977(R2006)<br>CSA O115-M1982<br>CSA O121-M1978<br>CSA O141-05<br>CAN/ULC-S102-03<br><br>NHLA<br><br>NLGA | Basic Hardboard Standard<br>Decorative Laminate Countertops, Performance Standards for Fabricated High Pressure Particleboard<br>High Pressure Decorative Laminates<br>Architectural Woodwork Standards, Edition 1<br>Cabinet Hardware<br>High Pressure Paper Base, Decorative Laminates<br>Interior Mat-Formed Wood Particleboard<br>Hardboard<br>Wire Nails, Spikes and Staples<br>Hot Dip Galvanizing of Irregularly Shaped Articles<br>CSA Standards for Wood Adhesives<br>Hardwood and Decorative Plywood<br>Douglas Fir Plywood<br>Softwood Lumber<br>Test for Surface Burning Characteristics of Building Materials and Assemblies<br>National Hardwood Lumber Association Rules Book 2007<br>National Lumber Grades Authority, Standard Grading Rules for Canadian Lumber 2007 |
|-------|--|--|

**1.4 QUALITY ASSURANCE**

1.4.1 Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the trade and who are completely familiar with the specified requirements and methods needed for proper performance of the Work of this Section.

1.4.2 Millwork fabrication and installation shall conform to premium grade requirements of AWI Architectural Woodwork Standards.

**1.5 DESIGN**

1.5.1 Plastic-faced architectural casework and related components specified herein are based on Transitional Series casework manufactured by Aya Kitchens and Baths Ltd. The materials set forth herein shall establish a standard of quality by performance requirements and general description of product. The Consultant will

**PLASTIC FACED RESIDENTIAL CASEWORK**

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consider alternates provided proposed systems meet or exceed the requirements and standards set forth in this Section. The Consultant reserves the right to reject any material which in his opinion, will not produce the quality specified herein.

- 1.5.2 Submit alternates in accordance with the procedures set forth under Article 4 Material Variations in Instructions to Bidders.
- 1.5.3 Casework and related components shall be obtained from a single source.
- 1.5.4 Provide full flush overlay construction with 1/8" (3 mm) reveal between intra-cabinet doors and drawers and 1/16" (1.5 mm) reveal at cabinet edges for offset of hinges around doors and 1/8" (3 mm) reveal on adjacent cabinets. Adjust door and drawer fronts to maintain specified tolerances.
- 1.5.5 Slightly ease doors and drawer fronts at all edges.
- 1.5.6 No exposed fasteners allowed without prior approval of Consultant.
- 1.5.7 Cabinet elevations shall be built in symmetrical sizes as required to fill areas, unless shown/noted otherwise on Drawings.
- 1.5.8 Maximum filler size shall 4" (102 mm) and shall be balanced at each end of wall to wall elevations, unless shown/noted otherwise on Drawings.
- 1.5.9 Exposed faces and edges of door and drawer fronts shall be finished with thermofoil and semi-exposed faces shall be finished with matching melamine, unless otherwise noted.
- 1.5.10 Exposed edges and bottom edges of melamine-faced particleboard cabinet panels shall be concealed with PVC nosings, .020" (0.5 mm) thickness, of same pattern and colour as thermofoil facing on door and drawer fronts, unless otherwise noted.
- 1.5.11 Pattern and colour of all visible surfaces and edges of plastic-faced casework shall match pattern and colour of thermofoil finish on door and drawer fronts.

**1.6 SUBMITTALS**

- 1.6.1 Submit shop drawings for casework, including countertops and backsplashes. Include floor plan showing locations of casework, large scale plans and elevations of casework based on field measured dimensions and cross-sections. Show service runs, rough-in requirements and sink locations. Clearly indicate types, quantities and sizes of materials being supplied and show connections, edge details, cut-outs, attachments, reinforcing, blocking, anchorage and locations, numbers and types of fastenings, finishes and hardware.
- 1.6.2 Upon request, and before proceeding with work, submit 3-12"x12" (300 mm x 300 mm) samples of components that will be used to fabricate casework, including but not limited to, top, bottoms, divider, finished gable, adjustable shelf and door/drawer front along 12" (300 mm) length of toekick for review. Show finishes, colours and details of edging, forming and construction.
- 1.6.3 Before proceeding with Work, submit coloured samples of melamine and thermofoil finishes from manufacturer's standard range for selection by Consultant. Allow complete freedom of pattern, finish and colour choice.
- 1.6.4 Before proceeding with Work, submit coloured samples of plastic laminate from manufacturer's standard range for selection by Consultant. Allow complete freedom of pattern, finish and colour choice.



- 1.6.5 Submit samples of proposed millwork hardware for review and approval.
- 1.6.6 Submit manufacturer's care and maintenance data for plastic-faced casework and countertops. Include in Data Books.
- 1.7 DELIVERY, STORAGE AND HANDLING**
- 1.7.1 Do not deliver finish material during rain or damp weather and keep all material dry during delivery and after arrival on Site.
- 1.7.2 Do not deliver casework to Site until installation areas are sufficiently dry and Work that could otherwise damage or soil casework is complete.
- 1.7.3 Deliver and handle all materials and components carefully. Adequately package to protect from soiling or damage.
- 1.7.4 Store casework items in areas of installation. Protect from damage until installation. If, prior to installation, it is necessary for casework to be temporarily stored in an area other than the installation area, the environmental conditions shall meet the environmental requirements specified under the Project Site Conditions article of this Section.
- 1.7.5 Provide coverings of suitable material to protect casework and finish materials from damage whether installed or stored within building. Take special precaution at corners.
- 1.8 PROJECT CONDITIONS**
- 1.8.1 Prior to delivery of products to Site:
- the building shall be enclosed (windows and doors sealed and weather-tight),
  - HVAC system that maintains temperature and humidity at occupancy levels shall be in place and be operational,
  - relative humidity shall be regulated and stable between 35% and 55% and temperature shall be regulated and stable between 63-75F (17-24C) to project completion and afterwards when in use by the owner,
  - ceilings, overhead ductwork and lighting shall be installed,
  - wet work shall be complete, and
  - required backing and reinforcements shall be in place and installation areas shall be ready for casework installation.
- 1.9 WARRANTIES**
- 1.9.1 Provide manufacturer's standard warranty naming Owner as beneficiary covering defects and deficiencies in materials and workmanship for period of
1. lifetime for hinges and drawer glides,
  2. 5 years for cabinet construction, and
  3. 2 years for cabinet doors, finishes and surface hardware (door and drawer pulls).
- from date Work is certified as Substantially Performed. Promptly correct defects and deficiencies which become apparent during warranty period, to satisfaction of Consultant and at no cost to Owner.

**2 PRODUCTS**

- 
- 2.1 MATERIALS**
- 2.1.1 General: All materials shall be straight, new, dry and clean in longest lengths possible and shall be properly sized and shaped to the correct dimensions from nominal sizes noted on Drawings.
- 2.1.1.1 Solid Lumber: carefully and thoroughly air-dried and then kiln dried to moisture content of 6-9 percent before use.
- 2.1.1.2 Fitment Framing: manufacturer's standard.
- 2.1.2 Particleboard: ANSI 208.1, Grade M-3, minimum density 40.6-46.8 lb./cu. ft. (650 - 750 kg/m<sup>3</sup>).
- 2.1.2.1 Edge Banding: .020" (0.5mm) PVC edging to match pattern and colour of thermofoil finish on door and drawer fronts.
- 2.1.3 Melamine-faced Particleboard: particleboard with thermally fused paper-resin coating formulated from polymerized melamine and formaldehyde laminated to faces and PVC edgebanding laminated to exposed/bottom edges. Pattern and colour on exposed faces and exposed/bottom edges shall match colour and pattern on door and drawer fronts.
- 2.1.3.1 Casework Bodies: 5/8" (16 mm) thick melamine-faced particleboard with PVC edgebanding laminated to exposed edges and bottom edges.
- 2.1.3.2 Adjustable Shelves: 5/8" (16 mm) thick melamine-faced particleboard with PVC edgebanding laminated to all edges. Pattern and colour on all faces and edges shall match colour and pattern on door and drawer fronts.
- 2.1.4 Combination Thermofoil and Melamine-faced Medium Density Fibreboard: medium density fibreboard with synthetic plastic material thermo-formed to exposed faces and edges and matching melamine laminated to semi-exposed faces, thickness as noted on Drawings. Allow for single pattern and colour from manufacturer's standard range of patterns and colours.
- 2.1.4.1 Fixed Panels and Doors and Drawer Fronts: Transitional style, square profile with flat centre panel, rail thickness: 3/4" (19 mm), stile and rail width: 2-1/2" (64 mm), except 6" (152 mm) high drawers have a 2" (50 mm) rail width, centre panel thickness: 1/2" (12.7 mm), door and drawer fronts become a slab when width or height is less than 8-7/8" (226 mm), except 6" (152 mm) high drawer fronts will remain profiled until width is less than 8-7/8" (226 mm), profiled drawer fronts less than 15" (381 mm) in width and slab drawer fronts less than 9" (229 mm) in width shall not be equipped with pulls. Aya Kitchens and Baths Ltd. Chesapeake.
- 2.1.5 Hardware:
- 2.1.5.1 Shelf Clips: lock in place, clear.
- 2.1.5.2 Door Hinges: full overlay, concealed, 110 degree, 6-way adjustable, clip-on type with stamped steel cup and hinge body, equip cabinet doors 39" (991 mm) high or smaller with 2 hinges, equip cabinet doors 42" (1067 mm) high or higher with 3 hinges, equip tall full height doors with 4 hinges. Hettich Canada, Sensys, or equivalent.
- 2.1.5.3 Drawer slides: soft close, double wall galvanized steel, steel ball bearing, 3/4 extension, side mount, 66 lb. (30 kg) static load rating. Hettich Canada, Quadro, or equivalent.

- 2.1.5.4 Door and Drawer Bumpers: rubber, 1/2" diameter, clear. Richilieu Hardware Ltd., Rubber Door Bumpers #9998CL, or equivalent.
- 2.1.5.5 Door and Drawer Pulls: curved metal, 5" (128 mm) centre to centre, 1.18" (30 mm) projection, finish: brushed nickel. Richilieu Hardware Ltd. Contemporary Metal Pull - 6500, #BP650020128195, or equivalent.
- 2.1.5.6 Provide additional hardware as required to complete the Work. Obtain Consultant's approval prior to ordering.
- 2.1.6 Adhesive:
  - 2.1.6.1 Glue for Wood Assemblies: CSA O112.4-M, polyvinyl.
  - 2.1.6.2 Glue for High Humidity Areas: CSA O112.5-M, Type II moisture resistant urea formaldehyde resin.
- 2.1.7 Fasteners: Nails, screws, grommets, bolts, staples, lag screws, anchors, special fastening devices and supports required for erection of carpentry components. Length, material strength and size to suit work and/or as recommended by manufacturer of material which is to be fastened.
- 2.1.8 Plastic Laminate: CAN3-A172-M. Premark Canada Inc., Arborite or equivalent.
  - 2.1.8.1 Face Sheet: GP-S, .042" (1.06 mm) to .050" (1.27 mm) thick.
  - 2.1.8.2 Backing Sheet: same thickness as face sheet, by same manufacturer as face sheet.
  - 2.1.8.3 Colours, Patterns and Surface Finishes: to later selection from manufacturer's standard range.
- 2.2 FABRICATION**
  - 2.2.1 General**
    - 2.2.1.1 Fabricate plastic-faced casework, including but not limited to, base cabinets, upper cabinets, vanities, counter units and moveable island complete with related components (ie. tops, bottoms, finished gables, dividers, fixed panels, counter supports, filler strips, scribe strips, plastic laminate countertops and backsplashes, etc.).
    - 2.2.1.2 Fabricate Work in accordance with premium grade requirements of AWI Architectural Woodwork Standards, best practices, to requirements of this and other Sections and as shown on Drawings.
  - 2.2.2 Take field dimensions and fabricate Work to suit field dimensions.
  - 2.2.3 Assemble Work in shop and deliver to Site ready for installation, as far as practicable. Leave ample allowance for fitting and scribing on Site.
  - 2.2.4 Use running members in greatest lengths obtainable.
  - 2.2.5 Frame materials with tight joints rigidly held in place.
  - 2.2.6 Design construction methods for expansion and contraction of materials.
  - 2.2.7 Machine dressed Work shall be slow fed using sharp cutter and finished Work shall

be free from drag, feathers, slivers or roughness of any kind. Remove machine marks by sanding.

- 2.2.8 Fabricate Work square, plumb, straight and true.
- 2.2.9 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by the Work of other trades. Accurately fit joints and intersecting members in true plane with adequate fastening. Locate joints over bearing or supporting surfaces. Use glue blocks where necessary.
- 2.2.10 Fasten wood nailers solidly to adjacent materials in true planes.
- 2.2.11 Glue, blind screw or nail all Work unless otherwise specified. Set surface nails and plug surface screws with wood plugs of material to match surface. Conceal nailing of tongued and grooved Work.
- 2.2.12 Mortise and tenon joints shall be glued and pinned.
- 2.2.13 Exposed edges and bottom edges of melamine-faced particleboard cabinet panels shall be concealed with PVC nosings, .020" (0.5 mm) thickness, of same pattern and colour as thermofoil facing on door and drawer fronts, unless otherwise noted.
- 2.2.14 Conceal joints and connections wherever possible. Locate prominent joints where directed by Consultant. Intermediate joints between supports not permitted.
- 2.2.15 Accurately scribe, cope and mitre members where required.
- 2.2.16 Finished Work shall be free of bruises, blemishes, mineral marks, knots, shakes and other defects and shall be selected for colour, grain and texture.
- 2.2.17 Be responsible for methods of fabrication and for ensuring that materials are rigidly and securely attached and will not be loosened by installation of items on Site or by Work of other trades.
- 2.2.18 Comply with glue manufacturer's recommendations for lumber moisture content, glue shelf life, pot life, working life, mixing, spreading, assembly time, time under pressure and ambient temperature.
- 2.2.19 Plastic Laminate Faced Work:
- Provide particleboard cores of not less than 3/4" (19 mm) nominal thickness.
  - Apply backing sheet to laminated flatwork. Supply uniform coating of sealer on exposed edges. Provide backing sheet of sufficient thickness to compensate for stresses caused by facing sheet.
  - Self edge, straight line edging with 1/16" (1.6 mm) standard material, apply with same adhesive as facing sheet. Chamfer edges uniformly at approximately 20E, using machine router.
  - Locate joints at 8'-0" to 10'-0" (2400 mm to 3000 mm) o.c. At 'L' shaped corners mitre plastic laminate, to outside corners. Accurately fit member together to provide tight and flush butt joints, in true planes. Provide 1/4" (6 mm) blind spline and approved type draw bolts. Provide 1 draw bolt for widths up to 6" (150 mm). For width exceeding 6" (150 mm), provide draw bolts at maximum 10" (250 mm) centres. Colour match adjoining units.
  - Provide cut outs as required for inserts, fixtures and fittings. Use radiused

corners and chamfered edges around cut outs to avoid chipping laminate.

- Assemble work, true and square. Arrange adjacent parts of continuous laminate work to match in colour and pattern.

2.2.20 Moisture content of casework shall be not less than 4% nor more than 8%.

2.2.21 Check access clearance at Site before assembling large units or components in shop for shipment.

### **2.2.22 Base Units**

2.2.22.1 Cabinet Construction: wood dowel and glue assembly, cabinets less than 39" (991 mm) wide are equipped with four (4) legs adjustable from 4-1/2" to 5-1/2" (102 mm to 140 mm) and located 2-1/2" (64 mm) from front and back edges and 1/2" (13 mm) from case ends, cabinets 39" (991 mm) wide or more are equipped with two (2) additional adjustable legs centred between case ends, load capacity for each leg: 250 lbs.

2.2.22.2 Case Ends: 5/8" (16 mm) thick melamine-faced particleboard with PVC edgebanding laminated to exposed edges and bottom edges, pre-drilled for adjustable shelving.

2.2.22.3 Cabinet Top Construction (except for sink cabinets): full stretcher frame consisting of 5/8" (16 mm) x 4-1/2" (114 mm) front and back top horizontal rails.

2.2.22.4 Cabinet Top Construction (sink cabinets): metal corner brackets.

2.2.22.5 Cabinet Bottoms: 5/8" (16 mm) thick melamine-faced particleboard with PVC edgebanding laminated to exposed edges.

2.2.22.6 Cabinet Backs: 1/8" (3 mm) hardboard with 5/8" (16 mm) x 4-1/2" (114 mm) hang rails behind.

2.2.22.7 Toe Kicks: 5/8" (16 mm) x 4-1/2" (114 mm), melamine-faced particleboard with PVC edgebanding laminated to exposed edges and bottom edges.

2.2.22.8 Adjustable Shelves: 5/8" (16 mm) thick melamine-faced particleboard with PVC edgebanding laminated to all edges, 14" (354 mm) depth. Pattern and colour on all faces and edges shall match colour and pattern on door and drawer fronts.

2.2.22.9 Drawer Construction: standard double wall, box sides double wall steel, box bottom and back 5/8" (16 mm) melamine-faced particleboard, interior wall height: 3-3/8" (86 mm), drawer depth: 18-7/8" (480 mm), gallery rails: 10-1/2" (257 mm) and higher, static load: 66 lbs, equipped with anti-slam mechanism.

2.2.22.10 Doors and Drawer Fronts: combination thermofoil and melamine-faced medium density fibreboard, full flush overlay construction, Aya Kitchen and Bath Ltd., Transitional Style, Chesapeake.

### **2.2.23 Wall/Tall Cases**

2.2.23.1 Cabinet Construction: wood dowel and glue assembly.

2.2.23.2 Case Ends: 5/8" (16 mm) thick melamine-faced particleboard with PVC edgebanding laminated to exposed edges and bottom edges, pre-drilled for adjustable shelving.

2.2.23.3 Case Tops and Bottoms: 5/8" (16 mm) thick melamine-faced particleboard with PVC edgebanding laminated to exposed edges.

- 2.2.23.4 Vertical Dividers: 5/8" (16 mm) thick melamine-faced particleboard with PVC edgebanding laminated to exposed edges, pre-drilled for adjustable shelving.
- 2.2.23.5 Cabinet Backs: 1/8" (3 mm) hardboard with 5/8" (16 mm) x 4-1/2" (114 mm) hang rails behind.
- 2.2.23.6 Adjustable Shelves: 5/8" (16 mm) thick melamine-faced particleboard with PVC edgebanding laminated to all edges, 14" (354 mm) depth for 24" (610 mm) deep cabinets and 9-3/4" (248 mm) depth for 12" deep cabinets. Pattern and colour on all faces and edges shall match colour and pattern on door and drawer fronts.
- 2.2.23.7 Doors: combination thermofoil and melamine-faced medium density fibreboard, full flush overlay construction, Aya Kitchen and Bath Ltd., Transitional Style, Chesapeake.

**2.2.24 Panels**

- 2.2.24.1 Panels: 3/4" (19 mm) thick melamine-faced particleboard with .040" (1 mm) PVC edgebanding laminated to exposed edges and bottom edges. Pattern and colour on exposed faces and exposed edges and bottom edges shall match colour and pattern on door and drawer fronts.

**3 EXECUTION****3.1 GENERAL**

- 3.1.1 Examine Specifications and Drawings and be familiar with Work of others which may affect the Work of this Section.
- 3.1.2 Supply to other trades any materials or articles required to be built-in to receive, accommodate or secure the Work of this Section, such as bolts, anchors, incidental miscellaneous metals and hardware. Notify other trades of any openings or other preparations required to be made by them for the Work of this Section.
- 3.1.3 Carry out all necessary cutting, fitting and making good of Work of this Section as is required to carry out the full intent of the Specifications and Drawings.
- 3.1.4 Do all cutting and fitting and prepare components to receive and accommodate Work of other Sections. Co-operate with other trades in installing items supplied by other Sections. Make good damaged or disturbed surfaces.
- 3.1.5 Execute all Work in co-operation with other trades and in sequence as required by the construction schedule.

**3.2 INSTALLATION**

- 3.2.1 Install Work in accordance with premium grade requirements of AWI Architectural Woodwork Standards, best practices, to requirements of this and other Sections and as shown on Drawings.
- 3.2.2 Do not commence plastic-faced casework installation in areas where building envelope is incomplete or where wet Work is not thoroughly dry.
- 3.2.3 Install plastic-faced casework where indicated on Drawings.
- 3.2.4 Be responsible for methods of installation and for ensuring that items and materials are rigidly and securely attached and will not be loosened by Work of other trades.

**PLASTIC FACED RESIDENTIAL CASEWORK**

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- 3.2.5 Joints made on Site shall be equal in quality and workmanship to joints made in shop.
- 3.2.6 Take care to prevent opening up of glue lines in finished Work.
- 3.2.7 Apply building paper over wood framing members in contact with masonry or cementitious construction.
- 3.2.8 Casework Installation:
  - 3.2.8.1 Set with components plumb, straight and square, securely anchored to building structure with no distortion. Use concealed shims where required.
  - 3.2.8.2 Fasten cabinets in continuous runs together with joints flush, uniform and tight with alignment of adjacent units not exceeding 1/16" (1.5 mm).
  - 3.2.8.3 Secure wall casework to solid material, not lath, plastic or gypsum board.
  - 3.2.8.4 Butt top edge surfaces in one true plane. Joints shall be flush and shall not exceed 1/8" (3 mm) between tops units.
  - 3.2.8.5 Adjust and align casework and hardware to allow for accurate connection of contact points and efficient operation of doors and drawers without any warping or binding.
- 3.2.9 Countertop Installation:
  - 3.2.9.1 Anchor countertops to underlying casework/blocking in single true plane with ends abutting at hairline joints and no raised edges at joints.
  - 3.2.9.2 Joints shall be factory prepared having no need for in-field processing of top and edge surfaces.
  - 3.2.9.3 Joints shall be dressed smoothly and surface scratches removed.

**3.3 SUPPLEMENTARY ITEMS**

- 3.3.1 Take possession of supplementary materials or items supplied by other Sections and check against shop drawings or other manufacturers' literature to ensure that all components are included.
- 3.3.2 Remove components of items that will require roughing-in during construction, then re-seal containers or packaging and store in protected place.
- 3.3.3 Install supplementary items as close as possible to the end of the project to reduce possible damage, but in sufficient time to coordinate the scheduling of items requiring finishes.
- 3.3.4 Protect before, during and after installation from damage by other trades.

**3.4 MISCELLANEOUS ITEMS**

- 3.4.1 Supply and install all other miscellaneous items specified herein, shown on the Drawings and as required for completion of the Work. Co-operate with other trades in installing items supplied by other Sections, cut openings in woodwork when required and make good damaged or disturbed surfaces.

**3.5 CLEANING**

**06411****PLASTIC FACED RESIDENTIAL CASEWORK**

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- 3.5.1 On completion, remove manufacturer's identification markings and clean finished surfaces. Remove excess materials, packaging and other debris from Site.
- 3.5.2 Ensure all components are unsoiled and match factory finish. Remove or repair damaged or defective components.
- 3.5.3 Thoroughly clean all finished surfaces, including countertops, drawers and cabinet shelves.
- 3.5.4 Protect counter tops with 1/4" (6 mm) ribbed cardboard or plastic covering.

**End of Section**



## SECTION 07200 - INSULATION

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Air barrier: Section 07270
- .2 Thermal insulation at metal wall cladding: Section 07410
- .3 Roof insulation and vapour retarder: Section 07551
- .4 Firestopping and smoke seals: Section 07840
- .5 Acoustical insulation inside gypsum board elements: Section 09250
- .6 Duct and pipe insulation: Division 15

#### 1.3 QUALITY ASSURANCE

- .1 Applicator of sprayed insulation shall be trained and approved by insulation manufacturer.

#### 1.4 PRODUCT STORAGE AND HANDLING

- .1 Deliver insulation to site in sealed wrappings bearing manufacturer's name, product name and RSI or KSI value.
- .2 Store materials in a dry area protected from the elements.

#### 1.5 PROTECTION

- .1 Temporarily protect installed insulation from damage and action of the elements until it is permanently concealed or protected.
- .2 Protect polystyrene insulation from sunlight.

### PART 2 - PRODUCTS

#### 2.1 INSULATION

- .1 Type 1: extruded, expanded polystyrene with shiplapped edges: CAN/ULC-S701-01: Styrofoam SM by Dow, or Enerspan by Plasti-fab..
- .2 Type 2: extruded polystyrene: CAN/ULC-S701-01, Silverboard XS Graphite by Amvic Building systems or Durofoam by Plasti Span.
- .3 Type 3: rigid fibrous insulation, glass fibre or mineral wool board: CAN/ULC-S702-97; density of 48 kg/m<sup>3</sup>; minimum RSI of 0.73 per 25 mm thickness: Series 700 by Owens Corning or OFI 48 by Ottawa Fibre Inc. or RXL 40 by Roxul Inc.
- .4 Type 4: mineral fibre, batt or roll type: CAN/ULC-S702-97.
- .5 Type 5: foamed in place urethane: two-component polyurethane: froth/spray kit, ULC Class 1 (flame spread 25 or less): Froth-Pak by Insta-Foam Products, Inc., Zerodraft Air Barrier Sealant by Building Resource Inc., or equivalent product by other manufacturer approved by Consultant.

#### 2.2 ADHESIVES AND FASTENERS

- .1 Adhesive for polystyrene insulation: Monsey Bakor 230-21; adhesive for securement of insulation to waterproofing / dampproofing membrane shall be compatible with such membranes.

## **SECTION 07200 - INSULATION**

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- .2 Impaling clips: zinc coated Stic-Klip with perforated base and cadmium plated speed washer by Eckel Industries of Canada Ltd., or Insul-Anchors "Spindle" by Continental Studwelding Ltd.; adhesive and mechanical fasteners as recommended by clip manufacturer.
- .3 Cavity insulation securement: supplied by Section 04200.
- .4 Mechanical securement system:
  - .1 Metal securement members: 41 x 13 x 0.5 mm galvanized channels: Insulok by Reach Plastics; or 48 x 13 x 0.5 mm galvanized tee: Retainer Tee by Bailey.
  - .2 Concrete/masonry anchors: Tapcon anchors of length to provide minimum 25 mm embedment of anchor.
  - .3 Fasteners to metal framing: self-drilling, self-tapping plated screws.

### **2.3 CAVITY COMPARTMENT SEALS, FIRESTOPS**

- .1 Sheet metal: minimum 0.9 mm thick sheet steel formed to profiles required, hot dip galvanized ASTM A525, zinc coating designation Z275.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- .1 Substrates to receive rigid board insulation, shall be sound, dry and free of dirt, oil, grease and other foreign substances.
- .2 Clean substrates as required. Remove concrete surface ridges and deposits.

### **3.2 INSULATION INSTALLATION - GENERAL**

- .1 Provide under this Section all thermal insulation required except where it is specified to be part of other Sections.
- .2 Provide continuous uniform thermal insulation over insulated areas.
- .3 Where insulation is interrupted by construction elements, neatly fit insulation around such elements and pack spaces around elements with same insulation.
- .4 Moderately butt insulation boards against each other so that there are no gaps.
- .5 Stagger joints at multiple layer installations.

### **3.3 INSULATION TYPE 1**

- .1 Provide Type 1 rigid board perimeter insulation at inside or outside of foundation walls as indicated, to minimum 600 mm below finished grade or lower where shown. Unless otherwise indicated provide 50 mm thick insulation bonded to substrate with spot adhesive application.
- .2 Where indicated provide Type 1 rigid board insulation below slabs on grade. Place insulation board on prepared, level subgrade, with joints tightly butted. Unless noted, use 50 mm thick insulation.
- .3 Where indicated provide Type 1 rigid board insulation below paving at building entrances/exits. Place insulation below paving base on suitably prepared level subgrade. Co-ordinate with Sections 02740 and 02770.

### **3.4 INSULATION TYPE 2**

- .1 At cavity walls place insulation against air barrier, tightly fitted at joints, at perimeter of insulated areas, around ties and at other penetrations; leave no gaps or voids.

## **SECTION 07200 - INSULATION**

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- .2 Secure insulation boards mechanically and with adhesive at all locations. Butter all edges of insulation boards with adhesive.
- .3 Provide continuous 12 mm beads of insulation adhesive applied in serpentine pattern, side to side, at back of insulation board; space beads at 150 mm o.c. Press board against air barrier and mechanically secure at each cavity wall tie, with insulation securement. At metal cladding locations secure insulation with impale clips or screw / disk fasteners.
- .4 Near wall corners, at perimeter of openings, and at other locations where cavity wall ties are not available in required location, use tapcon anchors and plastic washers for mechanical securement of insulation boards; ensure that fastener is within 150 mm of corner or jamb.
- .5 Do not install insulation until air barrier and membrane flashings are complete and have been approved by Consultant.

### **3.5 TYPE 3 INSULATION**

- .1 Secure insulation board to supporting work with adhesive bonded and mechanically fastened impale clips spaced at maximum 500 mm in each direction, unless otherwise indicated.

### **3.6 TYPE 4 INSULATION**

- .1 Completely fill spaces with insulation, leaving no gaps or voids. Do not pack insulation tighter than manufactured density of materials.

### **3.7 TYPE 5 INSULATION**

- .1 Apply insulation with suitable equipment, in accordance with manufacturer's directions.
- .2 Fill designated spaces completely, leaving no voids or gaps; trim excess material.

### **3.8 MECHANICAL SECUREMENT**

- .1 Space securement members at maximum 600 mm o.c. Provide additional members at openings, penetrations, corners, changes of directions and terminations to ensure firm securement and adequate support for gypsum board in all locations.
- .2 Fasten members to supporting elements maximum 150 mm from end of furring members and at maximum 600 mm at walls and at maximum 400 mm o.c. at horizontal applications.

### **3.9 SCHEDULE**

- .1 Unless otherwise indicated provide the following:
  - .1 Type 1 insulation: building foundations, in contact with soil (perimeter insulation); below slabs on grade;
  - .2 Type 2 insulation: cavity walls;
  - .3 Type 3 insulation: soffits and where rigid board insulation is required but no particular type is indicated;
  - .4 Type 4 insulation: where indicated;
  - .5 Type 5 insulation: perimeter of exterior window and aluminum door and screen frames;
  - .6 Provide mechanical securement of insulation at exterior gypsum board/cementitious board soffits and at other locations indicated.

**END**

## SECTION 07620 - METAL FLASHINGS

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Membrane flashings in masonry walls: Section 04200
- .2 Wood nailers, curbs and copings: Section 06100
- .3 Metal flashings relating to metal wall cladding: Section 07415

#### 1.3 DESIGN & PERFORMANCE REQUIREMENTS

- .1 Appearance: neatly and evenly lay out and install components. Exposed fastening devices not permitted.
- .2 Effects of wind: resist positive and negative wind pressures without causing detrimental effects.
- .3 Water control: prevent passage of water.
- .4 Thermal movement: accommodate expansion and contraction of component parts without causing buckling, failure of joints, undue stress on fasteners and other detrimental effects.
- .5 Compatibility: components shall be compatible with dissimilar metals and materials with which they are in contact or fastened to so as to prevent corrosion, staining and other detrimental effects. If required, treat or separate contact surfaces with inert and non-staining insulation material to achieve compatibility.

#### 1.4 SAMPLES

- .1 Submit minimum 300 mm long samples of typical flashings showing profile, method of locking and anchoring and corner condition, fabricated from materials specified.

#### 1.5 JOB CONDITIONS

- .1 Schedule and co-ordinate installation of metal flashing components with work of other Sections where it is integral or contiguous therewith.
- .2 Install metal counter and cap flashings immediately after installation and inspection of roofing membrane base flashings.

#### 1.6 WARRANTY

- .1 At no cost to Owner, remedy any defects in work, including work of this and other Sections, due to faults in materials and/or workmanship provided under this Section of Specifications appearing within a period of 2 years from date of Substantial Performance.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- .1 Prepainted sheet steel: zinc coated sheet steel, commercial quality to ASTM A 653/A 653M, with Z275 designation zinc coating, 10000 series QC 193 Black.
- .2 Galvanized sheet steel: ASTM A653 Grade A, zinc coating designation Z275.
- .3 Mechanical fastening devices: non-corrosive metal compatible with sheet metal.
- .4 Sealant: one part low modulus silicone to CAN/CGSB-19.18-M87. Consultant will select colour of sealant exposed in finished work.

## **SECTION 07620 - METAL FLASHINGS**

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- .5 Asphaltic paint: alkali resistant asphalt based enamel: CAN/CGSB-1.108-M89.

### **2.2 FABRICATION - GENERAL**

- .1 Shop fabricate metal flashing components, of prefinished sheet steel to profiles indicated. Where flashings are required but not detailed follow applicable requirements of SMACNA Architectural Manual. Provide the following minimum core thickness material unless otherwise indicated:
  - .1 Flashings: 0.5 mm (24 ga)
  - .2 Lockstrips: 0.9 mm (20 ga)
- .2 Provide components free from distortion, waves, twists, buckles and other defects detrimental to performance and appearance. Form sections square, true and accurate to size.
- .3 Double back exposed edges at least 12 mm.
- .4 Seams: space seams uniformly at maximum 2.5 m o.c. Unless otherwise indicated, use flat locked seams, lapped 25 mm. Make horizontal seams in directions of water flow. Mitre and seal corners.
- .5 Cleats and edge strips: non-corrosive metal compatible with sheet metal, thickness as required to provide rigid support and positive securement for metal flashings.
- .6 Unless otherwise indicated, counter flashings shall completely cover base flashings.
- .7 Furnish everything necessary for complete metal flashing installation, including clips and fastening devices.
- .8 Back paint metal flashings with asphaltic paint.
- .9 Fabricate scupper drains and downpipes to details and for locations indicated.

### **2.3 SLEEVE FLASHING SYSTEMS**

- .1 Aluminum 1.5 mm thick flashing system: by Thaler Roofing Specialties Products.
- .2 Fabricate sleeve flashings square or circular and of size to suit component being flashed. Unless otherwise indicated fabricate sleeves 450 mm high.
- .3 System shall consist of sleeve with flange and rain collar, and where applicable, bitumen protection cup.
- .4 Inside of jacket base flange and all sides of protection cup shall be coated with bituminous paint.
- .5 Size sleeves to allow minimum 25 mm thick insulation between component and sleeve.

### **2.4 VENT STACKS**

- .1 Aluminum 1.5 mm thick flashing system insulated with premoulded urethane insulation: SJ-4 by Thaler Roofing Specialties Products
- .2 Fabricate vent stack in size to suit stack.
- .3 Provide flashing jacket with base flange and protection cup. Paint inside of jacket, base flange and protection cup with bituminous paint.
- .4 Fabricate stacks 450 mm high unless otherwise indicated.

## SECTION 07620 - METAL FLASHINGS

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### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Provide sheet metal flashing at roof curbs, copings, penetrations, at junction of roof to wall, and where shown. Provide all wall cap flashings, except those specifically covered by other Sections.
- .2 Protect all membrane flashings with metal counterflashings.
- .3 Clean surfaces to be covered with metal flashings of dirt and other foreign matter. Drive projecting nails flush with substrate. Do not apply metal flashings over substrates likely to cause rupture.
- .4 Provide underlay of resin sized paper under metal flashings installed over masonry, concrete or wood. Lay underlay dry as sheet metal work is installed. Secure in place and lap joints 100 mm.
- .5 Secure flashings to supporting building elements with concealed continuous cleats and locking strips; avoid exposed surface fasteners.
- .6 Provide standing seam corners at cap flashings.
- .7 Where flashing is punctured by bolts, provide sheet lead or neoprene washers, 6 mm larger than bolt hole.
- .8 At reglets in masonry walls, secure metal flashings to reglet with mechanical fasteners at maximum 610 mm o.c.
- .9 Where vertical portion of metal flashing exceeds 300 mm provide vertical standing seams at 600 mm o.c.
- .10 Wherever possible, install sleeve flashing systems at penetrations through roof membrane. Install systems in accord with manufacturer's directions and as follows:
  - .1 Prior to installation of roofing membrane place bead of sealant around pipes, vent stacks and other components penetrating roof. Place bitumen protection cups over pipes into sealant.
  - .2 Insulate between penetrating elements and sleeve with 25 mm thick fibrous insulation.
  - .3 Prime contact surfaces with mastic cement; place flashing jackets onto roof membrane so that base flange is in contact with mastic cement placed on membrane.
  - .4 Sweat solder or weld on rain collar.
- .11 Install vent stacks in accord with manufacturer's directions.
- .12 Install scupper drains and downpipes in locations indicated. Fasten downpipes to supporting work near top and bottom and at maximum 1500 mm in between.
- .13 Imperfections in metal flashing work such as holes, dents, creases, or oil-canning will not be accepted.

**END**

## SECTION 07840 - FIRESTOPPING AND SMOKE SEALS

---

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Masonry, including mortaring in of fire dampers: Section 04200
- .2 Sealants other than specified herein: Section 07900
- .3 Firestopping within penetrating mechanical assemblies, (e.g. duct): Division 15
- .4 Firestopping within penetrating electrical assemblies, (e.g. bus duct): Division 16

#### 1.3 DESCRIPTION

- .1 Include in work of this Section all firestopping required except for firestopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside bus ducts) which shall be provided as part of work of Divisions 15 and 16 respectively. Firestopping and smoke seals around outside of such mechanical and electrical assemblies, where they penetrate fire rated separations, shall be part of work of this Section.
- .2 Firestop and seal (draft-tight) gaps, control joints, expansion joints and penetrations in fire rated assemblies, including assemblies with a zero rating, against passage of fire, smoke, gasses, firefighter's hose stream and, where designated, passage of liquids. Smoke seal at angle support at fire dampers.

#### 1.4 QUALITY ASSURANCE

- .1 Work of this Section shall be carried out by a firm specialized in the type of work specified herein. Use competent installers, experienced, trained and approved by material or system manufacturer for application of materials and systems being used. Installers shall have minimum 5 years experience in installation of firestopping materials.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in manufacturer's sealed and labelled containers.
- .2 Store materials in protected location prior to use, in accordance with manufacturer's directions.

#### 1.6 ENVIRONMENTAL CONDITIONS

- .1 Conform to manufacturer's recommended temperatures, relative humidity and substrate moisture content for storage, mixing, application and curing of firestopping materials.

#### 1.7 SUBMITTALS

- .1 Prior to start of work submit list of proposed firestopping and smoke seal materials together with suitable documentation to verify that specified requirements will be met. Provide the following information as applicable to this Project:
  - .1 ULC assembly number certification
  - .2 required temperature rise and flame rating
  - .3 hose stream rating (where applicable)
  - .4 thickness
  - .5 proposed installation methods
  - .6 material of firestopping and smoke seals, primers, reinforcements, damming materials, reinforcements and anchorages/fastenings
  - .7 size of opening
  - .8 adjacent materials

## **SECTION 07840 - FIRESTOPPING AND SMOKE SEALS**

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- .2 Upon Consultant's request submit samples of materials.
- .3 Upon completion of work submit written certification that work of this Section has been carried out in accordance with specified requirements.

### **1.8 MOCK-UPS**

- .1 At locations directed by Consultant prepare mock-ups of each type of firestopping/smoke seal required.
- .2 Provide linear firestopping/smoke seal mock-ups minimum 1 m long. Provide mock-up of each type or penetration firestopping.
- .3 Mock-ups may be incorporated into finished work if approved by Consultant.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEMS**

- .1 Firestopping and smoke seal systems shall be:
  - .1 tested in accordance with CAN/ULC-S115-05.
  - .2 listed by ULC or other fire testing agency approved by jurisdictional authorities.
  - .3 capable of providing fire resistance rating not less than that required by surrounding assembly.
  - .4 comply with F, T and H rating required.
- .2 Firestopping and smoke seals for vertical fire separations shall meet ULC Designation PJ, JF and HW as required for respective location.

### **2.2 MATERIALS**

- .1 Firestopping and smoke seal materials:
  - .1 Provide materials which are:
    - .1 PCB and asbestos-free
    - .2 of easily identifiable colour, except where used in exposed location
    - .3 suitable for intended application
    - .4 compatible with adjacent materials.
  - .2 Provide elastomeric type materials at locations requiring future re-entry (such as cable) and at penetrations for ducts and other mechanical items requiring sound and vibration control.
  - .3 Sealant type materials shall be non-sagging for vertical surfaces and self-levelling for level floors.
- .2 Primer: as recommended by firestopping material manufacturer for specific substrate and use.
- .3 Damming and back-up materials, support and anchoring devices: non-combustible, in accordance with tested assembly and as recommended by manufacturer.

### **2.3 MIXING**

- .1 Mix materials at correct temperature and in accordance with manufacturer's directions.



## SECTION 07840 - FIRESTOPPING AND SMOKE SEALS

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### PART 3 - EXECUTION

#### 3.1 PREPARATION

- .1 Remove combustible material and loose material detrimental to bond from edges of penetration. Clean, prime or otherwise prepare substrate material to manufacturer's recommendation.
- .2 Do not apply firestop material to surfaces previously painted or treated with sealer, curing compound, water repellent to other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .3 Verify openings, dimensions and surfaces conform to fire and smoke seal assembly.
- .4 Protect adjacent surfaces from marring or damage.
- .5 Prime surfaces in accordance with manufacturer's directions.
- .6 Remove insulation from area of insulated pipe and duct where such pipes or ducts penetrate fire separation unless ULC certified assembly permits such insulation to remain within assembly.
- .7 Provide temporary damming, forming, packing and bracing materials necessary to contain firestopping. Upon completion, remove forming and damming materials not required to remain as part of system.
- .8 Examine sizes, anticipated movement and conditions of opening and penetration to establish correct system and depth of backup materials and of firestopping material required.

#### 3.2 INSTALLATION

- .1 Seal penetrations through and gaps in fire rated separations in accordance with ULC listing for tested system selected.
- .2 Apply firestopping materials in accordance with manufacturer's instructions and tested designs. Apply with sufficient pressure to properly fill and seal openings to ensure continuity and integrity of fire separation. Tool or trowel exposed surfaces as required.
- .3 Remove excess compound promptly as work progresses and upon completion.
- .4 Unless otherwise indicated or permitted by Consultant recess firestopping and smoke seals in exposed locations to permit installation of decorative sealant by Section 07920.
- .5 Do not cover materials until full cure has taken place.
- .6 Provide firestopping and smoke seal systems at following locations, without being limited to:
  - .1 At all openings, voids and penetrations through all floor slabs except openings within shafts constructed with a fire resistance rating and slabs on granular fill.
  - .2 At all openings, voids, control joints and penetrations through fire rated masonry, concrete and gypsum board walls, partitions and shaft walls.
  - .3 At all openings, voids and penetrations installed for future use through fire rated masonry, concrete and gypsum board walls, partitions and shaft walls.
  - .4 Around mechanical and electrical assemblies penetrating fire rated assemblies.
  - .5 Between perimeter of all floor and roof slabs and exterior wall construction.
  - .6 Between curtainwall and adjacent assemblies.
  - .7 Between tops of all fire rated walls and partitions and underside of floor or roof slabs.
  - .8 At building expansion joints.

## **SECTION 07840 - FIRESTOPPING AND SMOKE SEALS**

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.7 Curing: cure materials in accordance with manufacturer's directions.

### **3.3 FIELD QUALITY CONTROL**

.1 Upon Consultant's request, manufacturer's representative shall inspect work of this Section and confirm in writing that it complies with specified requirements.

.2 Request Consultant's review of installed systems before they are covered by other work.

.3 Owner may arrange and pay out of cash allowance included in Section 01210 for inspection and testing of work of this Section by independent agency as directed by Consultant.

**END**

## SECTION 07920 - SEALANTS

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Caulking related to metal wall cladding: Section 07410
- .2 Caulking related to aluminium doors and frames: Section 08120
- .3 Caulking related to aluminium windows: Section 08520
- .4 Caulking related to aluminium curtain wall: Section 08910
- .5 Acoustic caulking at gypsum board elements: Section 09250

#### 1.3 DEFINITION

- .1 Caulking = Sealant.

#### 1.4 QUALITY ASSURANCE

- .1 Sealants must be installed by qualified caulking contractor with minimum five years experience and proven record of being able to produce good quality work.
- .2 Upon Consultant's request arrange for sealant manufacturer's technical representative to visit the site, investigate conditions and make recommendations in connection with work of this Section.

#### 1.5 PRODUCT HANDLING

- .1 Deliver sealants to site in sealed containers bearing manufacturer's name, brand name of sealant and reference standard to which sealant complies.
- .2 Store materials in a dry area having an ambient temperature within limitations recommended by material manufacturer.

#### 1.6 JOB CONDITIONS

- .1 Unless otherwise specified, apply sealants when air temperature is between 10°C and 25°C. When air temperature is above 25°C or below 10°C follow sealant manufacturer's recommendations regarding application.

#### 1.7 WARRANTY

- .1 At no cost to Owner remedy any defects in work, including work of this and other Sections, due to faults in materials and workmanship provided under this Section appearing within a period of 2 years from date of Substantial Performance.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- .1 Sealants:
  - .1 Exterior sealant for vertical joints: one-part ultra low modulus silicone sealant with joint movement capability of  $\pm 50\%$ ; custom colour selected by Consultant: ASTM C920, Type S, Grade NS, Class 25, uses NT, G, A, 0: standard of acceptance: Tremco Spectrem 1.
  - .2 Interior sealant for vertical joints: one part acrylic latex with joint movement capability of  $\pm 7 \frac{1}{2}\%$ , paintable: ASTM C834 Type OP, Grade -18°C, standard of acceptance: Tremflex 834.

## SECTION 07920 - SEALANTS

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- .3 Interior sealant for horizontal joints: multi-component, self levelling, chemically curing polyurethane: ASTM C920, Type M, Grade P, Class 25: Standard of acceptance: Tremco THC-900.
- .4 Interior sealant for wet locations: mildew-resistant silicone formulated with fungicide: ASTM C920, Type S, Grade NS, Class 25, Uses NT, G, A: standard of acceptance: Dow Corning 786 Mildew Resistant Silicone Sealant.
- .5 Colours: selected by Consultant from manufacturer's standard colours.
- .2 Primers, thinners, cleaners: as recommended by sealant manufacturer, non-staining type.
- .3 Premoulded backup for sealant: non-gassing closed cell foam rope, compressed 25% when in joint: Sof-Rod by Tremco, or Cera-Rod by W.R. Meadows.
- .4 Bond breaker: closed cell polyethylene or vinyl foam tape, self-adhering one side.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- .1 Examine joints to be caulked and report in writing to the Consultant any defects in work of other Sections which would impair installation, performance and warranty of sealants.
- .2 Do not commence installation of sealants until conditions are acceptable.
- .3 Start of work implies acceptance of conditions.

#### 3.2 PREPARATION

- .1 Clean and prepare joints to be caulked to produce clean sound surfaces for sealant adhesion.
- .2 Remove dust, oil, grease, water, frost, loose mortar and other foreign matter. Remove loose particles by blowing joint out with compressed air.
- .3 Chemically clean non-porous surfaces such as metal and glass, taking care to wipe solvents dry with a clean cloth. Use solvents recommended by sealant manufacturer.
- .4 Clean porous surfaces such as masonry, concrete and stone by mechanical abrading.
- .5 Surfaces adjacent to joints to be primed and which may be stained by primer shall be masked with tape before primer is applied.
- .6 Prime joints in accordance with sealant manufacturer's recommendations. Apply primer before installing premoulded backup.
- .7 Install premoulded backup in joints 6 mm and more in width. Roll rope type backup into joint, do not stretch or braid. Install bond breaker in joints less than 6 mm in width.
- .8 Protect adjacent surfaces from stains and contamination. Make good any damage caused.

#### 3.3 APPLICATION

- .1 Apply sealants under pressure using suitable equipment. Gun nozzle shall be of proper size to fit, and seal joint.
- .2 Force sealant into joints in full bead, making certain that void free contact is made with sides of joint. Tool joints to produce a slightly concave surface.
- .3 Caulking must appear as a concave recessed joint, free of ridges, wrinkles and embedded foreign matter. Caulking shall not spread or bulge beyond surfaces on each of joint.

## SECTION 07920 - SEALANTS

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- .4 Apply sealants in accordance with following table:

| <u>Joint Width</u> | <u>Sealant Depth</u> |
|--------------------|----------------------|
| 5 mm               | 5 mm                 |
| 10 mm              | 5 mm                 |
| 15 mm              | 7 mm                 |
| 20 mm              | 10 mm                |
| 25 mm              | 12 mm                |

- .5 Vent exterior joints as directed by Consultant.

### 3.4 CLEANING

- .1 As work progresses, remove sealant smears and stains from adjacent surfaces. Use cleaning method recommended by sealant manufacturer.
- .2 Leave adjacent surfaces in neat and clean condition.

### 3.5 SCHEDULE

- .1 Apply sealant at the following exterior locations:
- .1 Between dissimilar materials in exposed locations except where specifically indicated otherwise.
  - .2 Control joints in masonry elements.
  - .3 Joints between precast concrete elements and between precast concrete elements and adjacent work.
  - .4 Below door thresholds (double bead).
  - .5 At perimeter of door, screen and louvre frames.
  - .6 At penetrations through exterior building elements.
  - .7 Where indicated.
- .2 Apply sealant at the following interior locations:
- .1 Between dissimilar materials in exposed locations except where specifically indicated otherwise.
  - .2 Perimeter of exterior door, louvre and screen frames.
  - .3 Between interior door frames and wall where gap exceeds 1.5 mm or where gap is irregular.
  - .4 Control joints in masonry elements, and joints between bearing and non-bearing masonry walls.
  - .5 Building expansion joint, except where expansion joint covers are required.
  - .6 At ceramic tile control joints.
  - .7 Perimeter of firehose cabinets, access panels, and control panels.
  - .8 Between vanities/countertops and wall.
  - .9 Between interior door frame and flooring.
  - .10 Where shown.
- .3 At interior locations use acrylic emulsion sealant except:
- .1 At floor control joints use self levelling polyurethane.
  - .2 At vanities/countertops and at ceramic wall tile control joints use silicone sealant.
  - .3 Where expected joint movement exceeds movement capability of acrylic emulsion sealant, use sealant specified for exterior use, as directed by Consultant.

**END**

## **SECTION 08110 - STEEL DOORS AND FRAMES**

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### **QPART 1 - GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Comply with requirements of Division 1.

#### **1.2 RELATED WORK**

- .1 Grout fill for steel frames and fixed mullions: Section 04200
- .2 Intermediate steel posts at glazed steel screens: Section 05500
- .3 Caulking at frame perimeters: Section 07920
- .4 Supply only of finish hardware: Section 08710
- .5 Glazing: Section 08800
- .6 Painting: Section 09900

#### **1.4 QUALITY ASSURANCE**

- .1 Acceptable manufacturers:
  - .1 Artek
  - .2 Baron
  - .3 Daybar
  - .4 S.W. Fleming
  - .5 Metal Door
- .2 Reference standards: unless otherwise specified, meet requirements of "Canadian Manufacturing Specification for Steel Doors and Frames" and "Recommended Dimensional Standards for Commercial Steel Doors and Frames" published by the Canadian Steel Door Manufacturers' Association.
- .3 Fire protection requirements: fire rated doors and frames shall bear ULC or WHI label for required rating and shall be installed in accordance with NFPA 80 - Fire Doors and Windows, current edition. Provide temperature rise rated assemblies where required.

#### **1.5 WORK SUPPLIED BUT NOT INSTALLED**

- .1 Supply frames and anchors to other Sections where it is necessary to build frames into work of other Sections.
- .2 Supply instructions required for accurate positioning and proper installation of components supplied to other Sections.

#### **1.6 SHOP DRAWINGS**

- .1 Prepare and submit detailed shop drawings. Include door and frame schedules, materials and finishes, hardware preparations and frame anchorage details.

#### **1.7 PRODUCT HANDLING**

- .1 Tag doors and frames at shop with identification marks indicating proper location for installation.
- .2 Deliver, store and handle components so as to prevent damage, distortion and corrosion. Store components off the ground and under cover in a dry protected area. Stack doors and frames to prevent twisting. Do not enclose components in plastic covers without venting.

## SECTION 08110 - STEEL DOORS AND FRAMES

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### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- .1 Sheet Steel: hot dip galvanized (wipe coated) cold rolled steel with stretcher level degree of flatness, meeting requirements of ASTM A924 and A653; minimum zinc coating designation ZF120.
- .2 Core Material:
  - .1 Fire rated doors: in accordance with fire test requirements.
  - .2 Exterior doors: rigid polyurethane or rigid mineral fibre.
  - .3 Interior doors, except fire rated doors: honeycomb core of rigid, pre-expanded resin impregnated paper with maximum 25 mm hexagonal shaped cells.
- .3 Reinforcing steel: CAN/CSA-G40.21-04, Grade 300W, hot dip galvanized to CAN/CSA-G164-M92.
- .4 Finishing Materials:
  - .1 Touch up paint: zinc rich paint CAN/CGSB-1.181-92.
  - .2 Metal filler: two component epoxy type.

#### 2.2 HARDWARE PREPARATION

- .1 Prepare for mortised and cylindrical hardware in accordance with ANSI A115 Series standards, except where specified otherwise. Provide mortise lock preparation to ANSI A115.1, including integral reinforcement channel, mounting tabs, and lock support. Provide cylindrical lock preparation to ANSI A115.2, including integral latch case support.
- .2 Blank, reinforce, drill and tap doors and frames for concealed and mortised hardware. Reinforce doors and frames for surface mounted hardware. Provide door closer reinforcement at all steel doors and frames whether closer is required by hardware list or not. Provide exterior doors and frames to receive alarm system contact switches.

#### 2.3 DOORS

- .1 Construct fire rated doors in accordance with fire test requirements. Double doors shall be labelled without need for mullions, astragals or coordinating devices. Doors with transom panels shall be labelled with rebated interlocking head condition.
- .2 Provide all doors of seamless construction with no visible seams or joints on faces.
- .3 Exterior doors to be of hollow steel construction with all spaces filled with insulation; interior high traffic doors shall be of honeycomb core construction. Skins shall be 1.5 mm thick. Join door faces at vertical door edges by continuous weld, extending full height of door; grind, fill and dress smooth.
- .4 Interior doors except high traffic doors shall be of honeycomb core construction. Skins shall be minimum 1.2 mm thick. Join door faces at vertical door edges by tackwelding, filling and grinding smooth.
- .5 Interior high traffic doors shall be of steel stiffened construction with 1.5 mm thick door faces, jointed at door edges with continuous weld, ground, filled and dressed smooth. Provide high traffic doors at the following locations:
  - .1 Stair doors
  - .2 Cross corridor doors
  - .3 Interior vestibule doors
  - .4 Where shown.
- .6 Provide flush end closures made of steel at top edge of exterior doors and where required for attachment of hardware and weatherstripping.

## **SECTION 08110 - STEEL DOORS AND FRAMES**

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- .7 Hardware reinforcements shall be minimum 3.4 mm thick exclusive of door skin thickness. Provide reinforcement at all hardware fastening points.
- .8 Surround openings in flush doors with minimum 1.2 mm thick steel edge channels, welded to both face sheets.
- .9 Provide removable glazing stops of zinc coated steel channels mitred at corners, accurately fitted into position and fastened with oval head plated screws.
- .10 Glazing stops at exterior doors shall be located on the interior side.
- .11 Construct oversized doors to sizes indicated; frame and reinforce doors as required to maintain shape.

### **2.4 FRAMES**

- .1 Provide welded frames of 1.5 mm thick sheet steel to profiles shown, and as required to suit wall conditions. Provide T-style centre mullions. Provide door stops and glass stops formed integrally with frame and not added as a separate profile.
- .2 Construct fire rated frames in accordance with fire test requirements.
- .3 Assemble components with accurately cut joints. Mitre outside corner joints of frames. Continuously weld joints on inside of profile; grind welds, flush and sand to smooth uniform surface. Tab connectors and partial welding is not acceptable.
- .4 Fit and assemble work in the shop wherever possible, eliminating field joints.
- .5 Glazing stops shall be minimum 0.9 mm thick steel, mitred at corners, drilled and secured with oval head plated screws.
- .6 Side light and transom framing shall be of same thickness metal as adjacent door frame.
- .7 Drill interior door frames for rubber bumpers. Drill strike jamb of each single door frame for 3 bumpers. Drill head member of double door frames for 2 bumpers.
- .8 Provide angle or channel door head reinforcement for doors wider than 915 mm.
- .9 Tack weld two removable minimum 1.2 mm thick steel spreader channels to inside faces of door frames at base.
- .10 Provide adjustable base clips for anchorage to floor at bottom of each door jamb.
- .11 Protect hardware reinforcements at frames located in masonry elements with 0.9 mm thick guard boxes.
- .12 Hardware reinforcements shall be minimum 3.4 mm thick exclusive of frame thickness. Provide reinforcement at all hardware fastening points.
- .13 Where indicated provide removable mullions.
- .14 Make provisions to accommodate door intrusion alarm equipment at exterior door locations. Coordinate with alarm system supplier.
- .15 Make provisions to accommodate automatic door openers where required. Coordinate with Division 16.
- .16 Provide welded on metal drip at head of exterior doors.



## **SECTION 08110 - STEEL DOORS AND FRAMES**

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### **2.5 FINISHES**

- .1 Fill seams, corner joints and other depressions with filler and sand smooth.
- .2 Clean and remove all traces of oil, grease and other foreign substances to ensure proper bond of touch up after fabrication.
- .3 Touch up damaged zinc coating with zinc rich paint.
- .4 Insulate, where necessary to prevent electrolysis, metal surfaces in contact with dissimilar metals or cementitious materials.

### **PART 3 - EXECUTION**

#### **3.1 FRAME AND SCREEN INSTALLATION**

- .1 Allowable limit of distortion shall be 1.5 mm out of plumb at each jamb, measured on face of frame, resulting in maximum twist of frame of 3 mm measured from upper corner to lower diagonal corner.
- .2 Generally, anchorage of frames shall be by means of standard anchors. Where standard anchors cannot be used, provide special anchors to ensure proper installation. Method of anchorage shall not be visible when frames are installed.
- .3 Provide minimum 3 anchors at each jamb. At frames exceeding 2150 mm in height provide one additional anchor for each additional 610 mm, or part thereof.
- .4 Anchor intermediate vertical frame members to structure above as required to ensure stability. Where required, provide steel frame extensions. Provide flexible connection at structure to allow for deflection.
- .5 Remove steel shipping spreaders; install wood installation spreaders at sill and at third points of frame rabbet height to maintain constant frame width. Remove wood spreaders only after frames are securely anchored in place.
- .6 Remove spreader channels only after frames are securely anchored in place.

#### **3.2 DOORS**

- .1 Install steel doors and panels.
- .2 Install hardware in accordance with hardware supplier's instructions.
- .3 Adjust operable parts to ensure proper operation.

#### **3.3 TOUCH-UP**

- .1 Patch damaged shop primer. Remove rust, sand damaged and abraded surfaces and touch-up with zinc rich paint.

**END**

## **SECTION 08120 - ALUMINIUM DOORS AND FRAMES**

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### **PART 1 - GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Comply with requirements of Division 1.

#### **1.2 RELATED WORK**

- .1 Sealants, except as specified herein: Section 07920
- .2 Supply of aluminium door hardware: Section 08710
- .3 Miscellaneous glazing: Section 08800
- .4 Electrical power for automatic door operators: Division 16

#### **1.3 WORK SUPPLIED BUT NOT INSTALLED**

- .1 Supply to other Sections anchors, inserts and items required to be built into work of other Sections.
- .2 Ensure accurate setting of built-in items; where necessary provide templates, diagrams or other suitable means of instruction.

#### **1.4 DESIGN AND PERFORMANCE REQUIREMENTS**

- .1 Design exterior entrance systems to withstand, without any detrimental effects to appearance and performance, wind loads and temperature range expected in geographical area of this project (OBC climatic information 30 year probability), unless specified otherwise.
- .2 Design systems to accommodate without detrimental effects on appearance and performance of system.
  - .1 Positive and negative wind loads.
  - .2 Thermal expansion and contraction of systems components.
  - .3 Movement, deflection and creep of building structural frame.
- .3 Limit deflection of component parts under maximum design load to 1/175 of span or less if required by glass manufacturer.

#### **1.5 QUALITY ASSURANCE**

- .1 Installer qualifications: forces approved by manufacturer.
- .2 Fabrication tolerances: overall height, width and diagonal dimensions of frames shall be within the following tolerances:  
  
Dimension of 2 m and less: +/- 2 mm  
Dimension more than 2 m: +/- 3 mm
- .3 Caulking: comply with requirements of Section 07900 except where specifically stated otherwise herein.
- .4 Glazing: comply with requirements of Section 08800 except where specifically stated otherwise herein.

#### **1.6 SUBMITTALS**

- .1 Submit detailed shop drawings showing fabrication, assembly and installation requirements.
- .2 Upon Consultant's request, submit sample section and assemble corner of each framing system used.
- .3 Submit triplicate sets of samples minimum 50 x 100 mm of each type of metal finish specified.

## **SECTION 08120 - ALUMINIUM DOORS AND FRAMES**

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### **1.7 WARRANTY**

- .1 At no cost to Owner remedy any defects in work of this Section for a period of five (5) years from date of Substantial Performance.
- .2 At no cost to Owner replace any metal member whose finish shows any defects such as delamination, blisters or excessive fading within 5 years of Substantial Performance.
- .3 At no cost to Owner, replace factory sealed insulating window units should cracking of glass or any other breakdown or failure of glass units occur or should obstruction of visions develop due to dust or film forming on inner glass surfaces within a period of 10 years from date of Substantial Performance.

### **PART 2 - PRODUCTS**

#### **2.1 SYSTEMS**

- .1 Exterior screens: Alumicor BF 3400 Series
- .2 Exterior doors: Alumicor T600B Series Thermadoor.
- .3 Interior screens: Alumicor 2200 Series
- .4 interior doors: Alumicor 600B Series

#### **2.2 MATERIALS**

- .1 Framing Components:
  - .1 Aluminium extrusions: AA 6063-T54 alloy.
  - .2 Aluminium plate and sheet: AA 1100 alloy.
  - .3 Steel sections and plate: CAN/CSA-G40.21-04, Grade 300W.
  - .4 Steel tubes: CAN/CSA-G40.21-04, Grade 350W, Class H.
  - .5 Screws, bolts, nuts, washers, rivets and other fasteners incorporated into aluminium sections: aluminium or ANSI Series 300 stainless steel, or hot dip galvanized steel.
  - .6 Anchoring devices: aluminium, non-magnetic stainless steel or hot dip galvanized steel.
- .2 Glass and Glazing Materials:
  - .1 Setting blocks: Neoprene, Shore "A" Durometer hardness of 70 to 90 points; spacer shims, 40 to 50 points, as recommended by glass manufacturers.
  - .2 Glazing sealant: one part polysulphide meeting requirements of CAN/CGSB-19.13-M87 or as recommended by window and glass manufacturer.
  - .3 Glazing tape: preshimmed polyisobutylene: Polyshim Tape by Tremco.
  - .4 Glazing wedges and splines: solid extruded neoprene or EPDM having Shore "A"

## **SECTION 08120 - ALUMINIUM DOORS AND FRAMES**

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Durometer hardness of 50 to 70 points as recommended by window manufacturer.

- .5 Float glass: CAN/CGSB-12.3-M91, clear, Glazing Quality.
- .6 Tempered glass: CAN/CGSB-12.1-M90, clear.
- .7 Insulating glass: as specified in Section 08520.
- .8 Glass thickness: minimum 6 mm.
- .3 Caulking Materials:
  - .1 Sealant: one part low modulus silicone: Dow Corning 790; colours selected by Consultant.
  - .2 Primer: as recommended by sealant manufacturer.
  - .3 Joint backing: non-gassing foam rope, compressed minimum 25% when installed: Sof-Rod by Tremco.
  - .4 Miscellaneous Materials:
    - .1 Bituminous paint: alkali resistant asphaltic enamel.
    - .2 Bedding compound: non-hardening and non-skinning.

### **2.3 FRAMING**

- .1 Aluminium components shall be extruded sections and shapes unless otherwise specified.
- .2 Size units to allow for structural deflection of surrounding construction.
- .3 Design work so that it will not be distorted, nor fasteners overstressed, from expansion and contraction of metal.
- .4 Reinforce members as required to withstand loads and to maintain deflection within allowable limited.
- .5 Internally reinforce framing members where work of other Sections is to be fastened thereto.
- .6 Fastenings shall be concealed.
- .7 Mechanically joined sections shall have hairline joints.
- .8 Closures, covers and trim shall be extruded or formed to profiles shown and unless otherwise shown, minimum 3 mm thick.

### **2.4 DOORS**

- .1 Construct doors of minimum 5 mm thick porthole extrusions, with all fastenings and connections concealed.
- .2 Vertical edge profile: bevelled or rounded.
- .3 Glazing stops shall be square snap-on-type, without exposed fasteners.

## **SECTION 08120 - ALUMINIUM DOORS AND FRAMES**

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- .4 Provide cut outs, recesses, mortising required for finish and operating hardware.
- .5 Provide heavy duty reinforcing at all door and frame hardware fastening points.
- .6 Internally reinforce framing members where work of other Sections is to be fastened thereto.
- .7 Provide rails and transoms to sizes and profiles shown.
- .8 Prepare doors / frames for automatic door operator; provide head member of sufficient size to accommodate operator.
- .9 Prepare doors and frames to receive finish hardware supplied only by Section 08710. Prepare each door / frame for hinges, exit device, overhead closer, overhead stop, pull, threshold.
- .10 Weather stripping: provide manufacturer's standard weather stripping at jambs, head and bottom of exterior doors. Weather stripping shall be removable for replacement.

### **2.5 METAL FINISHES**

- .1 All exposed surfaces: anodized AA-A44 class1 18 um finish
- .2 Contact surfaces of aluminium components with dissimilar building components shall be coated with bituminous paint.

## **PART 3 - EXECUTION**

### **3.1 FRAMING**

- .1 Erect and secure framing plumb, square and level, free from warp, twist and superimposed loads.
- .2 Anchor framing to supporting building elements; provide brackets, anchors and clips as required. All devices for anchoring shall have sufficient adjustment to permit correct and accurate alignment. After alignment rivet, weld or otherwise positively lock anchoring devices to prevent movement other than that required to accommodate expansion, contraction and deflection.
- .3 Anchor intermediate vertical frame members to structure above as required. Where support for intermediate vertical frame members is not available directly above head, provide frame extensions to structure above. Provide flexible connection at structure to allow for movement.
- .4 Provide necessary inserts to be built into work of other Sections as required for anchorage of framing.
- .5 Set frame members in bedding compound to ensure watertight assembly.
- .6 Metal to metal joints between abutting components shall be sealed weathertight.
- .7 Use concealed fastenings and anchorages in all locations. Exposed fastenings, where unavoidable, must be clearly identified on shop drawings, and require Consultant's approval prior to fabrication of work.

### **3.2 GLAZING**

- .1 Glaze openings in accordance with window and glass manufacturer's recommendation, using dry-dry glazing method and so as to achieve weathertight installation.
- .2 Provide the following:

## **SECTION 08120 - ALUMINIUM DOORS AND FRAMES**

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- .1 Exterior screens: insulating glass; tempered inside and outside below 2m A.F.F.
- .2 Interior screens: single glazed; tempered inside and outside.
- .3 Doors: insulating glass; tempered inside and outside.

### **3.3 SEALANTS**

- .1 Seal joints in accordance with manufacturer's recommendations. Prime contact surfaces prior to installation of sealant.
- .2 Provide caulking between framing members and adjoining work and where required to render work of this Section weathertight.

### **3.4 COVERS, CLOSURES AND TRIM**

- .1 Provide covers, closures and trim as indicated and as required to provide complete and finished installation.
- .2 Wherever possible, provide concealed fastenings unless approved otherwise by Consultant.

### **3.5 DOORS AND HARDWARE**

- .1 Install doors.
- .2 Where doors are incorporated into curtain wall, coordinate with Section 08910.
- .3 Install finish and operating hardware and weatherstripping required, in accordance with hardware manufacturer's directions. Check test operation of all operable parts and, if necessary, adjust to ensure correct and smooth function.
- .4 Coordinate with Division 16 for required power connection and wiring to automatic door operator and controls.

### **3.7 CLEANING AND ADJUSTMENT**

- .1 Remove protective elements and thoroughly clean aluminium and glass surfaces with solution of mild domestic detergent in warm water. Exercise care in removing dirt from corners. Wipe surfaces dry using soft cloths.
- .2 Just prior to takeover of building by Owner, check test door hardware and weatherstripping and, if necessary adjust or replace components to ensure proper and smooth operation, and weathertight closure.

**END**

## SECTION 08210 - WOOD DOORS

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Cabinetwork doors: Section 06410
- .2 Steel frames: Section 08110
- .3 Supply of finish hardware: Section 08710
- .4 Glazing: Section 08800

#### 1.3 QUALITY ASSURANCE

- .1 Meet requirements of NWWDA I.S.I-A "Architectural Flush Doors" except where specified otherwise.
- .2 Fire rated doors shall bear ULC label.

#### 1.4 SAMPLES

- .1 Submit duplicate, minimum 300 x 300 mm samples of selected factory finished wood door facing.
- .2 Submit minimum 200 mm long sample of glazing stop for fire rated doors.

#### 1.5 PRODUCT DELIVER, STORAGE AND HANDLING

- .1 Protect doors from dampness. Arrange for delivery after work causing high humidity has been completed.
- .2 Protect doors from scratches, handling marks and other damage. Individually package doors in scuff and water resistant wrappings.
- .3 Label each door with manufacturer's name, product identification, door size and type.

#### 1.6 WARRANTY

- .1 At no cost to Owner, remedy any defects in work, including work of this and other Sections, due to defects in doors or frames provided under this Section appearing within a period of three (3) years from the date of Substantial Performance.
- .2 Defects covered under warranty shall include warp exceeding 6 mm.
- .3 Warranty shall cover all costs for replacement of defective doors including hanging, fitting and finishing.

### PART 2 - PRODUCTS

#### 2.1 SOLID CORE DOORS

- .1 Flush interior doors, 45 mm thick, meeting requirements specified herein: Marshfield Series by Weyerhaeuser or equivalent product by other manufacturer approved by Consultant.
- .2 Construct fire doors in accordance with fire test requirements.
- .3 Core: solid particleboard, to ANSI A208.1 Grade LD-2. Fire rated doors: in accordance with fire test requirements.
- .4 Door facing:

## **SECTION 08210 - WOOD DOORS**

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- .1 Wood veneer: 1.5 mm thick AWI/AWMAC Grade AA Maple, rotary cut, book matched, factory finished with clear satin catalyzed lacquer finish meeting AWI/AWMAC Quality Standard Section 1500, system #3, stain colour and lacquer sheen selected by Consultant.
- .5 Edge bands:
  - .1 Stiles: approximately 50 mm wide, including hardwood edge 15 mm, matching door face.
  - .2 Rails: approximately 50 mm high softwood.
- .6 Seal top and bottom edges with two coats of urethane sealer, in plant, prior to shipping.
- .7 Mineral core fire doors shall have pilot holes of 3 mm diameter for installation of hinges and screws shall be turned into pilot holes by use of manual screwdriver.
- .8 Factory prepare doors for door hardware in accordance with requirements of Section 08710.

### **2.2 HOLLOW CORE DOORS**

- .1 Flush interior doors, 35 mm thick, meeting requirements specified herein: Flush Door Hollow Core Series by Masonite or equivalent product by other manufacturer approved by Consultant.
- .2 Core: Corrugated Cell.
- .3 Door Facing: Hardboard
- .4 Edge bands:
  - .1 Stiles: approximately 50 mm wide, softwood.
  - .2 Rails: approximately 50 mm high, softwood.
- .5 Frames: flat wood jamb with door stops applied, machined for standard weight radius mortise 89 mm (3 ½") hinges.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- .1 Accurately fit doors into frames to ensure smooth operation without binding. Doors shall have 1.5 mm clearance at head and jambs and 6 mm over finished floor surfaces unless otherwise indicated.
- .2 Undercut doors where shown, and as required to accommodate floor finish thickness.
- .3 Make cutouts for door louvres where required.
- .4 Prepare for glazed openings to sizes indicated. Provide solid glazing stops of solid hardwood matching appearance of door facing. Mitre glass stops at corners.
- .5 Install hardware in accordance with hardware supplier's instructions.
- .6 Adjust operable parts to ensure proper door operation.

**END**



**Part 1            General**

**1.1            RELATED SECTIONS**

- .1        Section 01330 - Submittal Procedures.
- .2        Section 01780 - Closeout Submittals.
- .3        Section 07920 - Joint Sealing: caulking of joints between frames and other building components.
- .4        Section 07200 - Sprayed Insulation - Polyurethane Foam insulating of joints between frames and other structural and building components.

**1.2            REFERENCES**

- .1        Aluminum Association (AA), Designation System for Aluminum Finishes (2000)
- .2        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.
  - .2        CAN/CGSB-79.1-91, Insect Screens.
- .3        Canadian Standards Association (CSA) International
  - .1        CSA-A440/A440.1, A440, Windows / Special Publication A440.1, User Selection Guide to CSA Standard A440, Windows.

**1.3            SHOP DRAWINGS**

- .1        Submit shop drawings in accordance with Section 01330 - Submittal Procedures.
- .2        Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim and caulking. Indicate location of manufacturer's nameplates.

**1.4            SAMPLES**

- .1        Submit samples in accordance with Section 01330 - Submittal Procedures.
- .2        Submit one representative model of each type window.
- .3        Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Show location of manufacturer's nameplates.
- .4        Include 150 mm long samples of head, jamb, sill, meeting rail, mullions to indicate profile.

**1.5            TEST REPORTS**

- .1        Submit test reports from approved independent testing laboratories, certifying compliance with specifications, for:
  - .1        Windows classifications.
  - .2        finish, weathering characteristics.
  - .3        Insect screens.
  - .4        Air tightness.
  - .5        Water tightness.
  - .6        Wind load resistance.
  - .7        Condensation resistance.
  - .8        Safety drop - vertical sliding windows only.

## **SECTION 08500 - WINDOWS**

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- .9 Block operation - sliding windows only.
- .10 Sash strength and stiffness - [Operable Casement] [Projecting].
- .11 Ease of operation - windows with operable lights.
- .12 Sash pull-off - vinyl windows.
- .13 Forced entry resistance.
- .14 Mullian deflection - combination and composite windows.

### **1.6 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01780 - Closeout Submittals.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Materials: to CSA-A440/A440.1 supplemented as follows:
- .2 All vinyl windows by same manufacturer.
- .3 Sash: vinyl
- .4 Main frame: vinyl.
- .5 Glass: Triple Glazed Thermal Units.
- .6 Screens: to CAN/CGSB-79.1.

### **2.2 WINDOW TYPE AND CLASSIFICATION**

- .1 Types:
  - .1 Awning: with removable triple glazing insulating glass, brick mould trim.
    - .1 Acceptable material: Seymour Windows.
  - .2 Fixed: with removable triple glazed insulating glass, brick mould trim.
    - .1 Acceptable material: Seymour Windows.
  - .3 Screens: on ventilating portion of windows.
- .2 Classification rating: to CSA-A440/A440.1.
  - .1 Air tightness: A3.
  - .2 Water tightness: B4.
  - .3 Wind load resistance: C2.
  - .4 Forced Entry: F10
  - .5 Insect Screens: S1.
  - .6 Glazing: SHGC 0.40  
U 1.64 W/m2

### **2.3 FABRICATION**

- .1 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:
- .2 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
- .3 Face dimensions detailed are maximum permissible sizes.

## **SECTION 08500 - WINDOWS**

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- .4 Brace frames to maintain squareness and rigidity during shipment and installation.

### **2.4 VINYL FINISHES**

- .1 Vinyl finishes: in accordance with CSA-A440/A440.1, including appendices, supplemented as follows:
  - .1 colour white

### **2.5 GLAZING**

- .1 Glaze windows in accordance with CSA-A440/A440.1.

### **2.6 HARDWARE**

- .1 Hardware: stainless steel or white bronze sash locks to provide security and permit easy operation of units.

### **2.7 AIR BARRIER AND VAPOUR RETARDER**

- .1 Equip window frames with site installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder as follows:
  - .1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.
  - .2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

## **Part 3 Execution**

### **3.1 WINDOW INSTALLATION**

- .1 Install in accordance with CSA-A440/A440.1.
- .2 Arrange components to prevent abrupt variation in colour.

### **3.2 SILL INSTALLATION**

- .1 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Use one piece lengths at each location.
- .2 Secure sills in place with anchoring devices located at ends joints of continuous sills and evenly spaced 600 mm on centre in between.

### **3.3 CAULKING**

- .1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
- .2 Apply sealant in accordance with Section 07920 - Joint Sealing. Conceal sealant within window units except where exposed use is permitted by Consultant.

**END OF SECTION**

## **SECTION 08710 - DOOR HARDWARE**

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### **PART 1 - GENERAL**

#### **1.1 RELATED SECTIONS**

|    |                                      |               |
|----|--------------------------------------|---------------|
| .1 | Allowances                           | Section 01210 |
| .2 | Finish Carpentry                     | Section 06400 |
| .3 | Joint Sealer:                        | Section 07900 |
| .4 | Steel Hollow Metal Doors & Frames    | Section 08110 |
| .5 | Aluminium Doors, Frames and Screens: | Section 08500 |
| .6 | Wood Doors:                          | Section 08210 |
| .7 | Smoke Detection :                    | Division 16   |
| .8 | Security Access:                     | Division 16   |
| .9 | Electrical Wiring and Conduit:       | Division 16   |

#### **1.2 SUMMARY**

- .1 Furnish and delivery of all finish hardware necessary for all doors. This includes the installation of Power Operators. The hardware shall include the furnishing of all necessary screws, special screws, bolts, special bolts, expansion shields, drop plates and all other devices necessary for the proper installation of the hardware.
- .2 Supply of Hardware shall be from Allowances in Section 01210.

#### **1.3 RELATED DOCUMENT**

- .1 Drawings and general provisions of contract including general and supplementary conditions and Division 1 specification section applies to this section.
- .2 The Consultant approval of the schedule will not be construed as certifying that the list is complete. Acceptance of the Hardware Schedule does not relieve the supplier of responsibility of errors or omissions.
- .3 Hardware should not be ordered unless a corrected copy of the shop drawings is reviewed and returned from the specification writer and bearing the approval of the Architect/Engineer.
- .4 All similar items must be from one manufacturer.
- .5 Provide Electronic Security Hardware, Access Control System, of type and size shown on the drawings and in Schedules, complete in place, as specified herein, and as needed for a complete and properly functioning installation.
- .6 Division 16 to provide high voltage wiring and conduit to the door opening or power supplies including conduit to hardware locations.
- .7 All similar items must be from one manufacturer.

## **SECTION 08710 - DOOR HARDWARE**

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### **1.4 REFERENCES**

- .1 American National Standards Institute, ANSI A117.1 Specification
- .2 NFPA - National Fire Protection Agency
  - .1 NBC
  - .2 NFPA-80
  - .3 NFPA101 - Life Safety
  - .4 NFPA-105 - Smoke and Draft Control
- .3 Standards CSA
  - .1 American National Standards Institute - ANSI
  - .2 NFPA - National Fire Protection Agency
    - .1 NBC - National Building Code (1995)
    - .2 NFPA-80 - Standard for Fire Doors and Windows (1999)
    - .3 NFPA101 - Life Safety Code (2000)
    - .4 NFPA-105 - Smoke and Draft Control
  - .3 Standards
    - .1 Construction Standards Association (CSA)
    - .2 Codes - NFPA-80
    - .3 Standard Hardware Locations in Accordance with the Canadian Steel Door and Frame Association Guidelines
    - .4 Barrier-Free Design CAN/CSA-B651-95
    - .5 Recommended locations for Architectural Hardware for Wood Flush Doors.
    - .6 ANSI/BHMA A156.1-2006, Butts and Hinges.
    - .7 ANSI/BHMA A156.26-2006, Continuous Hinges.
    - .8 ANSI/BHMA A156.2-2005, Cylindrical Locks and Latches.
    - .9 ANSI/BHMA A156.3-2001, Exit Devices.
    - .10 ANSI/BHMA A156.4-2000, Door Controls (Closers)
    - .11 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.
    - .12 ANSI/BHMA A156.6-2005, Architectural Door Trim.
    - .13 ANSI/BHMA A156.7-2003, Template Hinge Dimensions.
    - .14 ANSI/BHMA A156.8-2005, Door Controls - Overhead Holders.
    - .15 ANSI/BHMA A156.10-2005, Power operated Pedestrian Doors.
    - .16 ANSI/BHMA A156.16-2002, Auxiliary Hardware.
    - .17 ANSI/BHMA A156.18-2006, Materials and Finishes.
    - .18 ANSI/BHMA A156.19-2007, Power Assist and Low Energy Power Operated Doors.
    - .19 ANSI/BHMA A156.21-2006, American National Standards for Thresholds.
    - .20 ANSI/BHMA A156.22-2005, Door Gasketing and Edge Seal Systems.
    - .21 ANSI/BHMA A156.25-2002, Electrified Locking Devices.
    - .22 ANSI/BHMA A156.2

### **1.5 SUBMITTALS**

- .1 General Submittals in accordance with 01330.
- .2 Prepare and submit within 30 days of receipt of purchase order.
- .3 Finish Hardware Schedule is to be submitted as per DHI vertical format which is in the "Sequence and Format for Hardware Schedules". Eight copies are required.
- .4 Product Data Sheets or Catalogue cuts are required. Three copies will be required.
- .5 The Finish Hardware Schedule must include manufacturer's make, model, material, function, size, finish and any other information required.

## SECTION 08710 - DOOR HARDWARE

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- .6 Samples to be provided if required by the Architect/Engineer. Samples must be returned in good condition.
- .7 Templates must be supplied only after final approval of Finish hardware Schedule has been reviewed and returned. Templates are required for all manufacturers that must prepare products for installation of hardware.
- .8 Keying Schedule to be in accordance with DHI manual "Keying Systems Names and Nomenclature". Key schedule is not to hold up the processing of the hardware list.
- .9 Wiring Diagrams will only be supplied after the final approval of the Finish Hardware Schedule. Submit wiring diagrams as requested for proper installation of electrical, electrical-mechanical and electrical-magnetic products.

### 1.6 QUALITY ASSURANCE

- .1 Substitutes will be considered if they are applied for in writing 10 days before tender closing. Substitutions by other manufacturer's must be equal in quality, design, function and finish to what is specified.
- .2 The hardware supplier must have a certified Architectural Hardware Consultant or equivalent on staff. This person must be qualified to inspect, detail, setting, applying and adjusting hardware. They must also have warehousing facilities.
- .3 Electrical Security Hardware must be coordinated with the Consultant and Electrical Engineer. Proper installation and technical data must be provided to the Architect/Engineer, Electrical Consultant and Contractor upon completion.

### 1.7 STORAGE AND HANDLING

- .1 All items of hardware should be itemized and tagged as per the approved Finish Hardware Schedule.
- .2 Hardware should be in manufacturer's original packaging.
- .3 Hardware is to be inventoried on site and confirmed by the Contractor and Hardware Supplier.
- .4 Contractor to secure and lock up in a dry room. Boxes to be off the floor.
- .5 Shortages will not delay installation.
- .6 Items damaged in shipment will be replaced properly with proper material.
- .7 All Hardware shall be handled in a manner to avoid damage, marking and scratching.

### 1.8 WARRANTY

- .1 Warranty start date is from substantial completion.
- .2 No liability is to be assumed where damage is due to improper installation, usage or abuse.
- .3 Provide guarantee.

|    |                    |                             |
|----|--------------------|-----------------------------|
| .1 | Closers            | 10 year                     |
| .2 | Locksets           | 7 year (Lifetime Lever Sag) |
| .3 | Exit Device        | 5 years                     |
| .4 | Hinges             | Lifetime of Building        |
| .5 | All other Hardware | 1 year                      |
| .6 | Card Readers       | Lifetime Replacement        |
| .7 | Magnetic Locks     | Lifetime Replacement        |

## **SECTION 08710 - DOOR HARDWARE**

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### **1.9 MAINTENANCE**

- .1 Provide three sets of maintenance tools for closers, locks and exit devices as well as a complete set of installation instructions.
- .2 After the building is occupied, arrange for an appointment with the owner to instruct them of proper use, service, adjusting and maintenance of the hardware furnished in this section.
- .3 Extra Material if required.

### **1.10 INSPECTION**

- .1 The hardware supplier shall arrange at least three visits to the job site.
  - .1 Visit project prior to delivery of hardware and inspect the personnel who will be looking after the installation and issuing of hardware at the job site.
  - .2 Second visit will take place when about sixty percent of hardware is installed. Check all hardware on site and correct any errors or shortages. Co-ordinate with general contractor and Consultant to determine proper time for visit.
  - .3 Third visit shall take place just prior to building turnover. All hardware shall be checked for proper installation and adjustment. Any errors shall be corrected and adjustments made. Check the key system and furnish a report along with maintenance manuals detailing any errors found.
  - .4 Cost of this service will be included as part of this Section and is not covered by any allowance amount.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- |    |                   |  |
|----|-------------------|--|
| .1 | Hinges            | McKinney – ASSA ABLOY Door Security Solutions Canada,<br>160 Four Valley Drive, Vaughan, Ontario, L4H 4T9. |
| .2 | Continuous Hinges | McKinney – ASSA ABLOY Door Security Solutions Canada,<br>160 Four Valley Drive, Vaughan, Ontario, L4H 4T9. |
| .3 | Locks             | Yale – ASSA ABLOY Door Security Solutions Canada,<br>160 Four Valley Drive, Vaughan, Ontario, L4H 4T9.     |
| .4 | Exit Devices      | Yale – ASSA ABLOY Door Security Solutions Canada,<br>160 Four Valley Drive, Vaughan, Ontario, L4H 4T9.     |
| .5 | Closers           | Norton – ASSA ABLOY Door Security Solutions Canada,<br>160 Four Valley Drive, Vaughan, Ontario, L4H 4T9.   |
| .6 | Flush Bolts       | Trimco<br>3528 Emery Street, Los Angeles, California 90023, USA  |
| .7 | Overhead Stops    | Rixson – ASSA ABLOY Door Security Solutions Canada,<br>160 Four Valley Drive, Vaughan, Ontario, L4H 4T9.   |
| .8 | Flatware          | Gallery Speciality Hardware<br>676 Petrolia Road, Downsview, Ontario, M3J 2V2.                             |

**SECTION 08710 - DOOR HARDWARE**

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- .9 Floor/Wall Stops Gallery Speciality Hardware  
676 Petrolia Road, Downsview, Ontario, M3J 2V2.
- .10 Weatherstrip/  
Thresholds Pemko Canada - ASSA ABLOY Door Security Solutions Canada,  
160 Four Valley Drive, Vaughan, Ontario, L4H 4T9.
- .11 Key Cabinet Telkee  
60 Starlifter Ave. Dover Delaware 19901-9254.
- .12 Power Supplies Securitron – ASSA ABLOY Door Security Solutions Canada,  
160 Four Valley Drive, Vaughan Ontario, L4H 4T9.
- .13 Magnetic Locks Securitron – ASSA ABLOY Door Security Solutions Canada,  
160 Four Valley Drive, Vaughan Ontario, L4H 4T9.
- .14 Keypads Securitron – ASSA ABLOY Door Security Solutions Canada,  
160 Four Valley Drive, Vaughan Ontario, L4H 4T9.
- .15 Sliding Track K.N. Crowder  
1220 Burloak Drive, Burlington, Ontario, L7L 6B3

**2.2 MATERIALS**

- .1 All fasteners to come complete with the hardware as described. Hardware supplier must be advised immediately if required fasteners are not enclosed with hardware.
- .2 Hardware must be installed with fasteners supplied by the manufacturer.

**2.3 FINISHES DESCRIPTION MATERIAL BMHA**

|    |                 |                              |     |
|----|-----------------|------------------------------|-----|
| .1 | Exterior Hinges | Stainless Steel Metal, Satin | 630 |
| .2 | Interior Hinges | Satin Chromium Plated        | 626 |
| .3 | Locks           | Satin Chromium Plated        | 626 |
| .4 | Exit Devices    | Satin Chromium Plated        | 630 |
| .5 | Closers         | Aluminium Powder Coated      | 689 |
| .6 | Flatware        | Stainless Steel Metal, Satin | 630 |
| .7 | All other items | Satin Chromium Plated        | 626 |

**2.4 KEYING**

- .1 All locks to be keyed to a new master key system. All locks to be master keyed as per the owners instructions.
- .2 All locks to be interchangeable core.
- .3 All cylinders to be construction keyed.
- .4 All cylinders and keys to be visually stamped.
- .5 All locksets to be furnished with four cut keys.
- .6 Consult with the Consultant and the owner and secure written approval of the complete keying layout prior to placing lock order with the factory.
- .7 Grand masterkeys and masterkeys shall be sent directly to the owner by registered mail, return receipt if requested.
- .8 Hardware installer to replace construction cores with permanent cores and return to contract hardware supplier. Credit will be given to the contractor for the construction cores that are returned.



## SECTION 08710 - DOOR HARDWARE

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|    |                         |             |
|----|-------------------------|-------------|
| .8 | Supply                  |             |
| .1 | Grand Masterkeys        | 4           |
| .2 | Masterkeys              | 4 per group |
| .3 | Change Keys/Lock        | 4           |
| .4 | Construction Masterkeys | 10          |
| .5 | Control Keys            | 4           |

### 2.5 KEY CONTROLS

- .1 Provide a key control system, including envelopes, labels with self-locking clips, receipt forms, 3-way visible card index, temporary markers and permanent markers and standard metal cabinet. Allow for 150% of the number of locks required on the project.
  - .1 Provide complete cross index system set up by the Hardware Supplier and place keys on markers and hooks in the key cabinet as determined by the final key schedule.
  - .2 Install and give instruction to owner on how the system is to be used.
  - .3 Provide hinged-panel type cabinet for wall mounting.
  - .4 Standard of acceptance: AWC-250-S.

## PART 3 - EXECUTION

### 3.1 Examination

- .1 Examination should be done on all doors and frames to be assured all doors have a proper fit before hardware is installed.
  - .1 Templates:
    - .1 Send templates, if required, to any manufacturer requesting templates.
  - .2 Wiring Diagrams:
    - .1 Provide any special information, voltage requirements and wiring diagrams to other trades requiring such information.

### 3.2 Installation

- .1 Installation is to be done by a qualified tradesman, if technical assistance is required contact the hardware supplier.
- .2 Mounting heights as per standard hardware locations which shall be included in the hardware schedule for approval.
- .3 Degree of opening for doors with overhead holders, closers and other affected hardware shall be included in the hardware schedule for approval.
- .4 Only screws furnished by the manufacturer will be allowed.
- .5 Hardware should not be installed until all finishing is complete.
- .6 All hardware to be installed level plumb and true.

END

## SECTION 08800 - MISCELLANEOUS GLAZING

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Cabinetwork: Section 06410
- .2 Steel doors and frames: Section 08110
- .3 Glazing of aluminum doors and screens: Section 08120
- .4 Wood doors: Section 08210
- .5 Glazing of aluminum windows: Section 08520
- .6 Framed mirrors: Section 10800
- .7 Glazing of aluminum curtainwall: Section 08910

#### 1.3 QUALITY ASSURANCE

- .1 Follow recommendations of the Flat Glass Marketing Association (USA) "Glazing Manual" latest edition.
- .2 Every pane of glass shall be factory labelled and label shall remain in place until final cleaning. Safety glass shall have permanent identification.

#### 1.4 WARRANTY

- .1 At no cost to Owner, replace factory sealed insulating window units should obstruction of vision develop due to dust or film forming on inner glass surfaces within a period of 10 years from date of Substantial Performance.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- .1 Setting blocks: neoprene, Shore 'A' durometer hardness of 70 to 90 points; spacer shims, 40 to 50 points, as recommended by glass manufacturer.
- .2 Glazing sealant: one part polysulphide to CAN/CGSB-19.13 -M87 or one part silicone to CAN/CGSB-19.18-M87.
- .3 Glazing tape: polyisobutylene tape; acceptable product: Tremco 440 tape.
- .4 Glazing gasket: Tremco Vision Strip; colour selected by Consultant.
- .5 Float glass: clear float glass to CAN/CGSB-12.3-M91 Glazing Quality.
- .6 Tempered glass: unless otherwise indicated, fully tempered float glass to CAN/CGSB-12.1- M90. Tempered glass identification must be sandblasted into glass and shall be visible after installation.
- .7 Wired glass: polished, clear glass with square mesh to CAN/CGSB-12.11-M90.
- .8 Insulating glass: as specified in Section 08520.
- .9 Laminated glass: clear, with .030 vinyl interlayer, CAN/CSA-12.1-M90.
- .10 Mirror glass: clear float glass, silvered, mirror quality to CAN/CGSB-12.5-M86.

## SECTION 08800 - MISCELLANEOUS GLAZING

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- .11 Mirror adhesive and protective coating as recommended by mirror manufacturer.

### PART 3 - EXECUTION

#### 3.1 GLASS INSTALLATION GENERAL

- .1 Do not glaze when ambient or surface temperature is less than 5°C. Ensure that glazing rabbets, stops and glass are dry, free of frost, grease, oil, dust, rust or other substances detrimental to adhesion of compounds and sealants.
- .2 Provide clearance at perimeter edge of glass on all four sides, minimum equal to glass thickness. Accurately cut glass to fit openings, allowing for expansion in accordance with glass manufacturer's recommendations.
- .3 Provide sealer space between face of glass and glazing stops of minimum 3 mm.
- .4 Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying glazing tapes, gaskets and compounds. Use solvents and cleaning agents recommended by manufacturer of sealing materials.
- .5 Install glazing tapes uniformly with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.
- .6 Set glass on setting blocks, spaced as recommended by glass manufacturer. Provide at least one setting block at quarter points from each corner.
- .7 Centre glass in glazing rabbet to maintain specified clearances at perimeter on all four sides. Maintain centered position of glass in rabbet and provide the required sealer thickness on both sides of glass.
- .8 Use spacers and shims in accordance with glass manufacturer's recommendations.
- .9 Carefully remove glazing stops and reinstall after glazing.

#### 3.2 INTERIOR GLAZING

- .1 Glaze interior openings as follows:
  - .1 Apply glazing tape to permanent stop; centre glass in opening and set on setting blocks; apply glass and press against tape.
  - .2 Apply glazing tape to removable stops and install stops. Trim tape for neat appearance.

#### 3.3 EXTERIOR GLAZING

- .1 Unless otherwise indicated glaze exterior openings as follows:
  - .1 Apply glazing tape to permanent stop; butt tape joints and weld together; do not overlap joints; daub tape corners with sealant.
  - .2 Set glass on setting blocks, align edges and press home to ensure adhesion at all points.
  - .3 Apply heel bead of sealant around perimeter of glass, maintaining 5 mm bite to glass and positive bond to frame. Completely seal void around glass edges. Sealant shall partially fill channel between glass and removable stop.
  - .4 Install removable stops; insert spacer shims between glass and stops at approximately 610 mm o.c. not less than 6 mm below sight lines. Fill remaining void with glazing compound or sealant to sight line and trim to clean line leaving no voids or depressions.
  - .5 Glazing gaskets may be installed in lieu of backfilling with sealant or glazing compound after setting removable stops.

## **SECTION 08800 - MISCELLANEOUS GLAZING**

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### **3.4 MIRRORS**

- .1 Install mirrors at locations indicated.
- .2 Bond mirrors to substrate with spot adhesive method in accordance with material manufacturer's recommendations.
- .3 Prior to applying adhesive, coat back of mirror with protective coating and allow to dry.
- .4 Where mirror cannot be produced in one piece, provide two or more panels. Accurately cut, fit and polish panels at joints.
- .5 Provide stainless steel trim with concealed mounting at exposed mirror edges.

### **3.5 CLEANING**

- .1 Remove dirt, scum, plaster, paint spatter, and other harmful and deleterious matter from glass promptly and completely, before they establish tight adhesion.
- .2 Avoid using abrasives, steel wool, razor blades, solvents, alkaline or other harsh cleaning agents.
- .3 Remove glazing compound droppings promptly from all surfaces as the work progresses.
- .4 Replace scratched or otherwise damaged glass.

### **3.6 SCHEDULE**

- .1 Provide glazing for the following elements and components:
  - .1 Steel doors and screens.
  - .2 Wood doors.
  - .3 Display case doors and shelves.
  - .4 Cabinetwork.
  - .5 Mirrors, except those provided by Section 10800.
  - .6 Other glazing shown and not covered in other Sections.
- .2 Provide the following glass:
  - .1 Wire glass: fire rated locations.
  - .2 Insulating glass: where indicated.
  - .3 Tempered glass: display cases and doors / screens, except where wire glass is required, and where indicated.
  - .4 Mirror glass: where indicated.
  - .5 Float glass: at all locations except where other type is required.
  - .6 Provide glass thickness indicated. Where no thickness is indicated, provide 6 mm thick glass.

**END**

## **SECTION 09250 - GYPSUM BOARD**

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### **PART 1 - GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Comply with requirements of Division 1.

#### **1.2 RELATED WORK**

- .1 Thermal insulation: Section 07200
- .2 Air barrier: Section 07270
- .3 Firestopping and smoke seals: Section 07840
- .4 Caulking: Section 07900
- .5 Supply of steel door frames: Section 08110
- .6 Painting: Section 09900
- .7 Supply of access doors: Divisions 15 & 16

#### **1.3 DEFINITION**

- .1 Drywall = gypsum board.

#### **1.4 FIRE PROTECTION REQUIREMENTS**

- .1 Provide fire rated gypsum board components and assemblies as indicated.
- .2 Comply with requirements of Section 01060.
- .3 Where firehose cabinets, electrical panels or other fixtures or equipment are recessed into fire rated gypsum board partitions, provide fire rated backing to maintain required fire rating.
- .4 Protect recessed fixtures in fire rated gypsum board ceilings in accordance with fire rated assembly design report and/or as indicated.
- .5 Gypsum bulkheads/partitions in ceiling spaces above fire rated glazed screens, doors or other elements shall have same fire rating as screens/doors over which they occur.
- .6 Fire rated bulkheads are required in first floor ceiling spaces where construction changes from fire rated floor assembly to non-fire rated roof assembly. Carefully examine Drawings to determine locations.

#### **1.5 WORKMANSHIP STANDARDS**

- .1 Interior metal framing and furring: comply with applicable requirements of ASTM C754 and ASTM C840 unless otherwise shown.
- .2 Gypsum board application and finish: comply with requirements of ASTM C840, unless otherwise shown.

#### **1.6 PRODUCT HANDLING & STORAGE**

- .1 Handle gypsum board panels to prevent damaged and broken edges.
- .2 Store materials in dry place so as to preserve their quality and fitness for work.

## **SECTION 09250 - GYPSUM BOARD**

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### **1.7 JOB CONDITIONS**

- .1 Install and finish gypsum board when ambient temperature is between 14 and 22°C. Maintain this temperature range in areas to receive gypsum board for 24 hours before and during application and until joint cement and adhesives are fully cured.
- .2 Apply gypsum board after building has been completely enclosed. Ensure that work to be concealed by gypsum board has been installed, tested, inspected and approved before starting work.

### **PART 2 - PRODUCTS**

#### **2.1 FRAMING, FURRING AND TRIM**

- .1 Unless otherwise specified, provide framing members of minimum 0.5 mm core thickness steel hot dip galvanized (wipe coat) to ASTM A653.
- .2 Studs, interior locations: channel shaped screw-on type: depth as indicated; with knurled supporting flanges at least 34 mm wide; with service pass-through holes at 610 mm o.c. in web. Provide minimum 0.9 mm thick studs where stud depth exceeds 92 mm and where cementitious board and abuse resistant gypsum board is supported.
- .3 Top and bottom runners: channel sections, 35 mm legs and service pass-through holes at 610 mm o.c. Depth to suit studs. Provide oversized top runner where required to accommodate deflection of structure.
- .4 Rough framing members: 38 x 19 x 1.2 mm and 19 x 13 x 1.2 mm galvanized steel channels.
- .5 Furring and strapping members to receive gypsum board: 19 mm deep channel shaped section with outstanding flanges and 35 mm wide knurled supporting face.
- .6 Corner beads: beaded angle with perforated flanges.
- .7 Casing beads: channel shaped; beaded corners.
- .8 Hangers: minimum 3 mm galvanized steel wire.
- .9 Tie wire: minimum 1.5 mm soft annealed galvanized steel.
- .10 Metal control joint section: bellows shaped section with perforated flanges.
- .11 Reveal mouldings: extruded aluminum, profiles as indicated, by Fry, Gordon or Pittcon Soffforms.

#### **2.2 GYPSUM BOARD**

- .1 Exposed gypsum board for interior use: tapered edge; ASTM C1396.
- .2 Unexposed gypsum board for interior use: backing board: ASTM C1396.
- .3 Fire rated gypsum board: Type 'X' board: ASTM C1396.
- .4 Moisture resistant gypsum board: ASTM C1396.
- .5 Gypsum sheathing: Dens Glass Gold by Georgia Pacific.
- .6 Abuse resistant gypsum board: 16 mm thick fire rated with tapered edge: Fiberock VHI by CGC.

#### **2.3 CEMENTITIOUS BOARD**

- .1 Board for paint finish:
  - .1 Board: polymer modified, fibreglass mesh reinforced concrete board, 12 mm thick, tapered edges: Perma Board by Unifix.

## **SECTION 09250 - GYPSUM BOARD**

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- .2 Joint tape: 75 mm wide alkali resistant fibreglass mesh tape: Unitape by Unifix.
- .3 Joint compound: acrylic based: Acryjoint by Unifix.
- .4 Skim coat: Acrybase by Unifix.
- .2 Board for textured finish or backing for ceramic tile: Durock by CGC 12 mm thick, or equivalent product by other manufacturer approved by Consultant.

### **2.4 FASTENING & FINISHING MATERIALS**

- .1 Drywall screws: self-drilling, self-tapping, case hardened. Use zinc, nickel or cadmium plated screws for fastening of gypsum sheathing and cementitious board.
- .2 Laminating adhesive: CGC Durabond 90 compound by CGC.
- .3 Joint tape: 50 mm perforated type.
- .4 Joint filler and topping cement: vinyl or latex base, slow setting.

### **2.5 ACOUSTICAL MATERIALS**

- .1 Acoustic Insulation: Acoustical Fire Batt by Roxul or equivalent product by Fibrex or Quiet Zone by Owens Corning.
- .2 Caulking: to ASTM C920: Acoustical Sealant by Tremco, or CGC Acoustical Sealant.

### **2.6 THERMAL BREAK**

- .1 Adhesive face rubberized cork 3 mm thick or self adhesive closed cell neoprene sponge tape "Permastik" 122X by Jacobs and Thompson Ltd., or foamed vinyl tape "Arnofoam" by Arno Adhesive Tape Inc.

## **PART 3 - EXECUTION**

### **3.1 METAL FRAMING**

- .1 General:
  - .1 Framing and furring indicated is schematic and shall not be considered exact or complete. Location and spacing of members, bracing, supports and securement shall be in accord with referenced standards as required to provide complete and finished work.
  - .2 Make provision for supporting recessed and surface mounted fixtures and equipment. Provide additional framing, supports and stiffeners as required.
  - .3 Neatly frame around recessed fixtures and openings.
  - .4 Examine mechanical and electrical drawings and coordinate with Divisions 15 and 16 to determine openings required.
- .2 Partitions:
  - .1 Unless specified or shown otherwise, extend steel studs to underside of structural slab or deck above. Make provisions to accommodate structural creep and deflection.
  - .2 All steel studs shall be spaced at 400 mm maximum, except where indicated otherwise. At curved walls/partitions space studs closer so as to maintain uniform curvature.
  - .3 Install runner channels at top and bottom of partition and secure to supporting building elements at maximum 610 mm o.c.

## SECTION 09250 - GYPSUM BOARD

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- .4 At partition corners extend one runner channel to end of corner and butt other runner channel; allow clearance for gypsum board thickness; do not mitre runner channels.
  - .5 Install steel studs vertically; fix studs to runner channels by crimping or screwing on both sides of stud.
  - .6 Install additional studs as detailed and required at partition intersections, openings and terminations at dissimilar materials. Place studs not more than 50 mm from abutting walls, openings and each side of corners.
  - .7 Stiffen partitions over 3.6 m in height at mid-height with at least one 19 mm horizontal bracing channel extending full length of partition.
- .3 Ceilings and Soffits:
- .1 Erect suspension and furring system level with a maximum tolerance of  $\pm 3$  mm over a 3000 mm length.
  - .2 Suspension system shall support ceiling assemblies, with maximum deflection of L/360, L being span between supports.
  - .3 Hangers for suspended ceilings shall support grillage independent of walls, columns, pipe and ducts. Space hangers at maximum 1220 mm o.c. along rough furring members and not more than 150 mm from ends. Do not suspend framing from steel roof deck.
  - .4 Space rough furring members at maximum 915 mm and not more than 150 mm from perimeter walls.
  - .5 Space furring channels transverse to runner channels at maximum 610 mm o.c. except at exterior soffits, and secure to each support with clip or saddle tie with 2 loops of tie wire. Install furring channels so as not to contact perimeter walls.
  - .6 Where ductwork, piping and other elements within ceiling spaces interfere with direct suspension of ceiling from structure, install additional framing securely fastened to main structure to accommodate proper hanging of ceiling.
  - .7 Erect exterior soffit framing in accordance with reviewed erection drawings. Suspend soffit framing with metal studs and brace system to withstand positive and negative wind pressures without detrimental effects. Fasten furring members to surrounding walls. Use minimum 1.2 mm thick framing members.
- .4 Bulkheads, Coves, Furring:
- .1 Frame to profiles shown, rigid, square, true to line and securely fastened to supporting building elements.
  - .2 Space furring members to receive gypsum board at maximum 610 mm o.c.
  - .3 Provide rough framing and bracing members as required to ensure stability and accuracy of work.

### 3.2 GYPSUM BOARD INSTALLATION

- .1 Unless otherwise specified, erect gypsum board vertically or horizontally, whichever results in fewer end joints.
- .2 Locate board end joints over supporting members.
- .3 Cut and fit gypsum board as required to accommodate other work.
- .4 Unless otherwise shown or specified, extend gypsum board on both sides of partitions to underside of structural deck above. Fasten gypsum board to studs, not to top channel. Allow for 13 mm deflection.



## **SECTION 09250 - GYPSUM BOARD**

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- .5 Do not install gypsum board until wood blocking or other back-up components are installed. Remove and reinstall gypsum board at no extra cost to Contract where this requirements is not complied with.
- .6 Provide corner beads at external corners.
- .7 Provide casing beads around openings and where gypsum board abutts dissimilar material and construction.
- .8 Fasten gypsum board to supports with screws spaced at maximum 305 mm o.c.
- .9 Install gypsum sheathing horizontally at outside of exterior wall steel studs. Fasten each board at each stud with minimum 3 screws.
- .10 Adhesive bonded gypsum board; apply 13 x 13 mm ribbons of laminating adhesive to back side of board, parallel to long dimension; space adhesive ribbons at max.150 mm o.c. temporarily brace boards until complete adhesive bond develops.
- .11 Where double layer is required screw fasten second layer through first into steel framing. Select screws of suitable length to ensure positive fastening. Offset joints in second layer.

### **3.3 CEMENTITIOUS BOARD**

- .1 Screw fasten board to each supporting member at maximum 300 mm o.c.
- .2 Finish cementitious board joints at locations scheduled to be painted with 3-step joint finishing system as recommended by board manufacturer. Apply skim coat over entire board surface to achieve smooth, uniform surface, ready for painting. Provide corner and casing beads similar to gypsum board installation.

### **3.4 GYPSUM BOARD FINISHING**

- .1 Tape and fill exposed joints, fastener heads, edges, corners, to produce an acceptable surface ready for decoration.
- .2 Conceal exposed flanges of corner beads, casing beads and other trim sections with at least 3 coats of cement, feathered out minimum 200 mm.
- .3 Fill depressions at fastener head with cement, then apply 2 additional coats of cement to produce smooth, level surface.
- .4 Treat joints using 3 coat method as follows:
  - .1 Apply thin uniform layer of cement and embed joint tape.
  - .2 Immediately apply thin skim coat of cement over tape and allow to dry.
  - .3 Apply 2 additional coats of cement. Allow first coat to dry before applying second coat.
- .5 Sand each coat of topping cement with fine sandpaper as required to produce smooth surface. Do not sand paper face of gypsum board.
- .6 Finish concealed fastener heads at fire rated gypsum board elements in manner specified for exposed work.
- .7 Finish concealed joints at fire rated and at acoustically insulated gypsum board elements in manner specified for exposed work.

## **SECTION 09250 - GYPSUM BOARD**

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### **3.5 CONTROL AND RELIEF JOINTS**

- .1 Control Joints:
  - .1 Provide control joints where shown and at maximum 8 m o.c.
  - .2 Break continuity of gypsum board and framing system at control joints; install continuous metal control joint section.
- .2 Relief Joints:
  - .1 Provide relief joints where shown and where gypsum board assemblies abutt dissimilar construction.
  - .2 Stop gypsum board 6 mm from abutting construction at dissimilar building elements, unless otherwise indicated.
  - .3 Where gypsum board comes into contact with window frames or exterior door/screen frames install thermal break. Adhere self-sticking tape to casing bead and compress during installation of gypsum board.
  - .4 Where indicated, install reveal mouldings.

### **3.6 SOUND CONTROL**

- .1 Acoustical Insulation: Provide acoustical insulation in gypsum board partitions and ceilings as indicated. Unless otherwise noted provide 50 mm thick insulation. Extend acoustical insulation over full height of partition, including portions located above ceiling.
- .2 Acoustical Caulking:
  - .1 Provide acoustical caulking at all partitions, bulkheads and ceilings scheduled to receive acoustical insulation as follows:
    - .1 At perimeter of gypsum board partitions and ceilings.
    - .2 Around objects penetrating gypsum board elements.
  - .2 Provide 2 bead caulking system around horizontal and vertical perimeters of partitions. Apply continuous sealant beads at each side of horizontal runner tracks and vertical end studs, between gypsum board and adjacent construction.
  - .3 Caulk around objects such as electrical outlets, light switches, electrical and mechanical panels and boxes, grilles, and other objects penetrating. Caulk behind metal control joint sections.
- .3 Where acoustically insulated partitions meet steel deck running perpendicularly to partition, provide steel deck closures.

### **3.7 DOOR FRAMES / ACCESS DOORS**

- .1 Install access doors supplied by Divisions 15 and 16. Build doors into gypsum board elements flush and parallel to walls and securely fastened.
- .2 Install steel door frames occurring in gypsum board partitions. Follow installation requirements specified in Section 08110.

### **3.8 GYPSUM BOARD SCHEDULE**

- .1 Use Type 'X' gypsum board at fire rated elements.
- .2 Use gypsum sheathing where indicated.
- .3 Use moisture resistant gypsum board where indicated.

## **SECTION 09250 - GYPSUM BOARD**

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- .4 Use abuse resistant gypsum board where indicated.
- .5 Provide cementitious board where indicated.
- .6 Unless otherwise specified or shown, provide 16 mm thick standard gypsum board.

**END**

## SECTION 09310 - CERAMIC TILE

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Finishing of concrete slabs: Section 03300
- .2 Caulking: Section 07900

#### 1.3 QUALITY ASSURANCE

- .1 Installer Qualifications: Member of Terrazzo, Tile and Marble Association of Canada (TTMAC) or approved by Consultant.

#### 1.4 SUBMITTALS

- .1 Of each type of tile required, submit sample consisting of minimum 4 tiles bonded to rigid board back-up and joints filled with grout. Select tiles to show full range of tile to be used. Resubmit sample if required until tile range and group colour is approved by the Consultant.
- .2 Submit list of mortar mixes and grouts to be used. In each case products proposed must be suitable for the purpose intended and they shall be capable to produce top quality work. Upon Consultant's request submit evidence of material manufacturer's endorsement of products proposed.
- .3 Upon Consultant's request submit samples of bases, trim and fittings.
- .4 Maintenance materials: provide an additional 2% of each type/colour tile required. Clearly identify each package and store where directed. Obtain receipt.

#### 1.5 MOCK-UP

- .1 Construct minimum 3 m<sup>2</sup> mock-up of ceramic tile, at location directed by Consultant.
- .2 Include coved horizontal joint, exterior bullnose and transition between different types of tile.
- .3 Mock-up may not be incorporated into finished work.

#### 1.6 JOB CONDITIONS

- .1 Maintain minimum air temperature of 10°C during installation and curing period.
- .2 Exclude construction traffic from areas to receive tile during installation and curing period.
- .3 Protect tile flooring subjected to construction traffic with non-staining protective covers.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- .1 Tile:  
Wall tile: CT1 - 6" x 6" Daltile "Semi-gloss group 1" complete with cap and all required trims

CT2 - Field Tile, 12 x 24 Sarana Trend – Aero Jet Gris  
Accent Tile, 12 x 24 Sarana – Textile Cotton Bianco

Floor Tile: 12" x 12". Centura Tile "Porcelain, Colour Bodied, Maski-Dot", matte finish, colour as selected by Consultant w/ matching coved base.

## **SECTION 09310 - CERAMIC TILE**

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- .2 Products by Laticrete listed herein are specified to establish a standard of acceptance. Equivalent products, subject to Consultant's review, by Mapei and H.B. Fuller (TEC) are also acceptable.
- .3 Water: potable and non-staining.
- .4 Portland cement: CAN/CSA-A5-03.
- .5 Sand: CSA A82.56-M1976.
- .6 Reinforcing: 50 x 50 x 1.6 mm hot dip galvanized steel wire mesh.
- .7 Thick bed mortar: high strength latex-portland cement mix: Laticrete 226/3701/8510.
- .8 Thin set mortar: latex-portland cement mix: Laticrete 211/4237.
- .9 High strength mortar: 100% solids epoxy adhesive: Latapoxy 300.
- .10 Organic adhesive: latex adhesive to ANSI A136.1: Laticrete 15 Multi-Mastic.
- .11 Floor grout: epoxy grout: Latapoxy SP-100; colours selected by Consultant.
- .12 Wall grout: unsanded dry set, coloured: Laticrete 600 Series/1776; colours selected by Consultant.
- .13 Control joints: Schlüter DILEX-BWB, height to suit tile thickness, colour selected by Consultant.
- .14 Edge trim: stainless steel angle profile: Schlüter Schiene-E, height to suit tile thickness or slab depression.
- .15 Cleaning compound: TTMAC 1001

### **2.2 MIXES**

- .1 Mortar and grout: mix using suitable mechanical mixers in accordance with material manufacturer's directions.
- .2 Place liquid into mixer, start mixer and add dry material. Mix only long enough to wet out batch; do not overmix. Dump mixed material from mixer promptly and clean out mixer with water after each batch.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- .1 Substrates shall be clean and free of foreign matter and minimum 10°C.
- .2 Clean substrates as required to produce acceptable surface.
- .3 Where substrate conditions require it, apply levelling coat and allow to cure.

### **3.2 WATERPROOFING MEMBRANE**

- .1 At floors with floor drains and where indicated at other areas, provide waterproofing membrane below ceramic tile. Follow manufacturer's directions.
- .2 Reinforce cracks in substrates and junctions of horizontal and vertical surfaces with 200 mm wide strip of waterproofing reinforced with 150 mm wide reinforcing fabric.
- .3 Apply waterproofing liquid with roller or brush and, while still wet, place reinforcing fabric onto it. Use brush to embed fabric and to smooth out wrinkles. Lap fabric 50 mm at seams. Apply second coat to cover fabric and let dry to touch. Apply final coat to completely seal membrane.

## SECTION 09310 - CERAMIC TILE

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- .4 Carry waterproofing membrane up and over curbs and up surrounding walls, minimum 150 mm high, but in no case shall membrane be visible in finished work.
- .5 Place liquid into mixer, start mixer and add dry material. Mix only long enough to wet out batch; do not overmix. Dump mixed material from mixer promptly and clean out mixer with water after each batch.

### 3.3 TILE INSTALLATION

- .1 Unless otherwise specified, meet applicable requirements of TTMAC Tile Installation Manual 2006-2007.
- .2 Bond tiles to substrate in accordance with mortar / adhesive manufacturer's directions and as follows:
  - .1 All locations except where indicated otherwise: thin set mortar.
  - .2 Porcelain base tile to all substrates: high strength mortar.
  - .3 Gypsum board substrate: organic adhesive.
  - .4 Cement board substrates: high strength mortar.
- .3 Finished work shall be level, plumb, true, square and free of defective, chipped, broken, discoloured or blemished tiles. Maximum allowable finished surface variation shall be 3 mm in 3 m when measured, in any direction, with a 3 m straightedge.
- .4 Lay out tile patterns symmetrically within each area and to patterns shown. Unless otherwise indicated provide stacked pattern. Provide checkerboard pattern at quarry tile floors.
- .5 Joints shall be parallel, uniform, neat, straight, square and of width directed by Consultant.
- .6 Fit tile neatly against and around interruptions, penetrations and abutting dissimilar surfaces. Wherever possible, drill holes for penetrating elements to ensure neat fitting.
- .7 After setting, sound tiles and replace hollow backed tiles.
- .8 Provide tile manufacturer's standard trim pieces at changes in direction and at terminations. Unless otherwise indicated provide the following corner and edge conditions:
  - .1 Internal horizontal corners: coved joint.
  - .2 External vertical and horizontal corners and edges: bullnose.
  - .3 Internal vertical corners and unexposed edges: square butt joint.
  - .4 At steps provide tread tiles complete with right and left angle corner tiles where required.
- .9 Where tile abuts dissimilar flooring, install edge strip.
- .10 Install 600 x 300 mm porcelain floor tile, of colour selected by Consultant, at elevator cab.

### 3.4 CONTROL JOINTS

- .1 Provide control joints at substrate control joint locations, at abutting dissimilar materials and at maximum 8 m in tile field. Review control joint locations with Consultant prior to start of work.
- .2 Install control joints as recommended by material manufacturer. Set control joints slightly lower than finish tile surface.

### 3.5 GROUTING

- .1 Commence grouting not earlier than 24 hours after setting tiles unless otherwise directed by grout manufacturer.
- .2 Force grout into joint so as to fill them flush, leaving no voids.

## **SECTION 09310 - CERAMIC TILE**

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- .3 Promptly as work progresses remove excess grout from adjacent tile surfaces before grout establishes tight permanent adhesion.
- .4 Cure grout in accordance with manufacturer's directions.

### **3.6 CLEANING**

- .1 Thoroughly clean and polish all ceramic tile surfaces in accordance with material manufacturer's recommendations.
- .2 Remove grout haze from tile surfaces. Use acid wash method if necessary.

**END**

## SECTION 09510 - ACOUSTICAL CEILINGS

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Mechanical fixtures: Division 15.
- .2 Electrical fixtures: Division 16.

#### 1.3 QUALITY ASSURANCE

- .1 Comply with applicable requirements of ASTM C636.
- .2 Design suspension system to support lighting fixtures in accordance with applicable regulatory requirements.

#### 1.4 SUBMITTALS

- .1 Submit ceiling grid manufacturer's statement verifying that ceiling grid as installed will safely support electrical light fixtures and other items installed into ceiling, within acceptable deflection limits.
- .2 Samples: submit two samples of each type of acoustical panel specified; size: 300 mm x 300 mm. Upon Consultant's request submit samples of suspension system components.
- .3 Maintenance materials: provide Owner with two full cartons of each type of acoustical panels. Obtain receipt and submit copy to Consultant.

#### 1.5 PRODUCT STORAGE

- .1 Store material in dry place, keep free of dampness.

#### 1.6 JOB CONDITIONS

- .1 Install ceiling systems after building has been completely enclosed and not before cementations building elements are complete and cured and humidity levels are acceptable in the opinion of the Consultant.
- .2 Ensure that work to be concealed by ceiling systems has been installed, tested, inspected and approved before starting work.
- .3 Co-ordinate with Divisions 15 and 16 for work to be built into work of this Section.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- .1 Acoustic Panels:
  - .1 Type 1 (ACT): 610 mm x 1220 mm x 16 mm with square edges; CGC, Fissured
  - .2 Type 2 (ACT): 610 mm x 610 mm x 16 mm with square edges; CGC, Fissured
- .2 Suspension system: exposed non-fire rated grid system: Prelude by Armstrong or equivalent system by Bailey or CGC:
  - .1 Main tees: 25 mm wide x 38 mm high bulb section, minimum 0.4 mm thick cold rolled galvanized steel. Main tee members shall be 3660 mm long.



## SECTION 09510 - ACOUSTICAL CEILINGS

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- .2 Cross tees: 25 mm wide, minimum 0.4 mm thick cold rolled galvanized steel; profile designed to limit deflection to 1/360 of span; designed to have suitable detail to rest on, automatically engage, level and lock to main tee.
  - .3 Wall moulding: prefinished exposed face galvanized steel angle.
  - .4 Hangers: minimum 2.5 mm (No. 12 SWG) galvanized steel wire.
  - .5 Carrying channels: minimum 1.2 mm thick cold rolled galvanized steel channels 38 x 13 mm.
  - .6 Finish for exposed metal surfaces: satin enamel, colour matching acoustic panels.
- .3 Suspension system: exposed fire rated grid system: Prelude XL Fire Guard by Armstrong or equivalent system by Bailey or CGC:
- .1 Main tees: 25 mm wide x 38 mm high bulb section, cold rolled galvanized steel. Main tee members shall be 3660 mm long.
  - .2 Cross tees: 25 mm wide, cold rolled galvanized steel; profile designed to limit deflection to 1/360 of span; designed to have suitable detail to rest on, automatically engage, level and lock to main tee.
  - .3 Wall moulding: prefinished exposed face galvanized steel angle.
  - .4 Hangers: minimum 2.5 mm (No. 12 SWG) galvanized steel wire spaced not more than 1200 mm along main Tees, at all four corners of light fixtures
  - .5 Hold Down clips: 0.5 mm spring steel, 25 mm high, 32 mm span and 10 mm wide. One clip per every 600 mm length of cross-tee.
  - .5 Carrying channels: minimum 1.2 mm thick cold rolled galvanized steel channels 38 x 13 mm.
  - .6 Finish for exposed metal surfaces: satin enamel, colour matching acoustic panels.
- .4 Accessories: splicers and fasteners, as required to provide complete and finished work; manufacturer's standard types.

### PART 3 - EXECUTION

#### 3.1 CEILING LAYOUTS

- .1 Lay out ceilings in accordance with reflected ceiling plans and symmetrical within each area to obtain uniform borders. Where layout is not shown install ceilings as directed by Consultant.
- .2 Finished work shall be plumb, level and square with adjoining work.

#### 3.2 SUSPENSION SYSTEM

- .1 Suspend ceilings directly from structural elements. Do not suspend from ducts, pipes, conduits, steel roof deck.
- .2 Erect suspension systems level with a maximum tolerance of 3 mm over 3 m length.
- .3 Install main tees in accord with module size. Suspend at maximum 1220 mm o.c.
- .4 Install cross tees perpendicular to main tees in accord with module size. Interlock with main tees.
- .5 Hangers for suspended ceilings shall support grillage independently of walls, columns, pipes and ducts. Space hangers at maximum 1220 mm o.c. along supporting grillage and not more than 150 mm from ends.

## **SECTION 09510 - ACOUSTICAL CEILINGS**

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- .6 Make provisions for carrying fixtures occurring on and in suspended ceilings. Install additional hangers and reinforcing to ensure that loads being carried do not compromise integrity of system. Frame around fixtures and openings as required.
- .7 Where ductwork, piping and other elements within ceiling spaces interfere with direct suspension of ceiling from structure, install additional framing securely fastened to main structure to accommodate proper hanging of ceiling.
- .8 Exposed members shall be as long in length as practical to minimize joints. Distribute joints to prevent clustering in one area. Joints shall be made square, tight and flush so that exposed faces of intersecting members are on same plane.
- .9 Joints in suspension system members shall be reinforced with splines or other suitable methods.
- .10 Install perimeter moulding at abutting vertical surfaces.
- .11 Install floating perimeter trim where edge of ceiling is exposed.
- .12 Where work of other Sections is fastened to acoustical ceilings, reinforce suspension system and/or acoustical panels in manner acceptable to Consultant.

### **3.3 ACOUSTICAL PANELS**

- .1 Install panels so that work is clean and unmarked.
- .2 Neatly cut and fit panels as required to suit ceiling layout and to accommodate other work.
- .3 Recessed items shall replace or be centred on panel unless otherwise indicated.

### **3.4 CLEANING**

- .1 After installation, clean and touch up minor surface defects on acoustical panels and gypsum board panels.
- .2 Remove damaged and badly marked units and replace with new unmarked material.

**END**

## **SECTION 09650 - RESILIENT FLOORING**

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### **PART 1 - GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Comply with requirements of Division 1.

#### **1.2 RELATED WORK**

- .1 Steel trowel finish of concrete slabs: Section 03300

#### **1.3 SUBMITTALS**

- .1 Submit manufacturer's full range of colours of each type of flooring and base material specified.
- .2 Submit seam layout for sheet vinyl floors for Consultant's review.
- .3 Submit maintenance instructions for inclusion into maintenance manual.
- .4 Maintenance materials: submit to Owner and obtain receipt, one additional full box, sealed, of each type and colour resilient floor tile used. Submit additional 2% of each type sheet flooring required.

#### **1.4 PRODUCT STORAGE**

- .1 Store flooring materials in areas of application for at least 48 hours prior to installation.

#### **1.5 JOB CONDITIONS**

- .1 Maintain minimum 21°C air temperature at flooring installation area for 3 days prior to, during and for 24 hours after installation.
- .2 Protect installed flooring against damage with heavy paper or plastic coverings. Do not place static loads on newly installed flooring until minimum 7 days after installation.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- .1 Flooring Finishes
  - 1. Vinyl Plank Tile (VP): 6" x 48", 2.5 mm thick. Centura Tile "Dura Contract Vista Plank Flooring" colour as selected by Consultant.
  - .2 Vinyl composite tile (VCT): 300 x 300 mm to ASTM F1066, Class 2, 3 mm thick. Armstrong Standard Excelon "Imperial Texture" field and 3 accent colours as selected by Consultant any 51-XXX Series colour.
- .2 Resilient base: 3 mm thick, 100 mm high, coloured rubber base, flat base at carpeted areas and coved base elsewhere; Johnsonite Resilient Rubber Base 'DC' or approved equivalent.
- .3 Vinyl reducing strips tapered, to suit thickness of flooring, colours selected by Consultant: Johnsonite RRS.
- .4 Vinyl adaptor resilient flooring to carpet: Johnsonite CTA-XX-D; colour selected by Consultant.
- .5 Primers, fillers, adhesives: those recommended by flooring manufacturer which will produce good and permanent bond between subfloor and flooring. Adhesive for resilient tile: high strength, clear setting type.
- .6 Cementitious underlayment: polymer modified quick-setting cement based: Flex Patch by Flextile or equivalent product by other manufacturer approved by Consultant.
- .7 Cleaning and finishing materials: as recommended by flooring material manufacturer.

## **SECTION 09650 - RESILIENT FLOORING**

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### **PART 3 - EXECUTION**

#### **3.1 CONDITION OF SUBSTRATES**

- .1 Surfaces to receive resilient flooring shall be dry, true, even and smooth, and free of paint, grease and oil.
- .2 Perform moisture tests on concrete substrates where moisture content is uncertain. Perform tests in minimum ambient temperature of 18°C. Do not install materials until test results are satisfactory.
- .3 Concrete slabs shall be at least 28 days old before installation of resilient flooring.
- .4 Inspect condition of concrete slabs scheduled to receive resilient flooring as soon as possible after completion and record in writing any deficiencies discovered or state, if no deficiencies are found, acceptance of floor conditions.

#### **3.2 PREPARATION**

- .1 Level depressions, cracks and joints in subfloor with non-shrinking type filler compatible with bonding adhesive.
- .2 If recommended by adhesive or tile manufacturer, prime substrates. Apply primer in accordance with manufacturer's directions.

#### **3.3 UNDERLAYMENT**

- .1 Where resilient flooring abuts other flooring of different thickness, provide cementitious underlayment allowing for smooth and level transition between finished floor surfaces.
- .2 Mix, apply and finish underlayment in accordance with latex admixture manufacturer's recommendations.

#### **3.4 FLOORING INSTALLATION - GENERAL**

- .1 Install resilient flooring materials in accordance with material manufacturer's current printed directions. Keep a copy of manufacturer's installation manual on site during execution of work.
- .2 Scribe flooring to walls, columns, cabinets, floor outlets and other appurtenances to produce tight joints. Extend flooring into recesses and closets.
- .3 Locate change to different floor finish or colour centred under doors.
- .4 Provide reducing strip adhesive bonded to floor where floor covering terminates, exposing edge of floor. Install transition strip at junction with other types of flooring.

#### **3.5 RESILIENT TILE**

- .1 Lay out each area to be tiled symmetrically square with axis of room to provide perimeter tiles at least one half tile in width.
- .2 Distribute tiles having varying shades or pattern evenly over floor area to obtain uniform effect. Abrupt variations will not be permitted. Tile joints shall be flush, uniform, in moderate contact and in straight lines.
- .3 Install tile with joints staggered half tile in one direction and with tile pattern running as directed by the Consultant.
- .4 Immediately after installation, roll entire floor to ensure adhesion in accordance with tile and adhesive manufacturer's recommendations.

#### **3.7 RESILIENT BASE**

## **SECTION 09650 - RESILIENT FLOORING**

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- .1 Adhesive apply cove base to vertical surfaces so that gaps do not occur behind base, so that front lip of base cove bears firmly and uniformly on floor surfaces and so that good and permanent bond is produced between base and surface to which is it applied.
- .2 Use full length pieces where practicable; accumulated short lengths not permitted. Wrap base around outside corners, mitre at inside corners; score back of coved base at outside corners. Use preformed end stops where base end is exposed. Butt joints flush without gaps.

### **3.8 CLEANING**

- .1 Promptly remove adhesive from surface of resilient materials as work progresses.
- .2 Immediately after installation, broom clean and wash resilient floors in accordance with material manufacturer's recommendations.
- .3 Owner will seal and wax floor immediately prior to turnover of building. Owner reserves the right to reject resilient floors which show defects after completion of sealing and waxing.

**END**

## SECTION 09900 - PAINTING

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### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Comply with requirements of Division 1.

#### 1.2 RELATED WORK

- .1 Pavement markings: Section 02761
- .2 Finish carpentry: Section 06200
- .3 Finishing of cabinetwork: Section 06410
- .4 Colour coding of concealed mechanical services: Division 15

#### 1.3 ACCEPTABLE MANUFACTURERS

- .1 Unless otherwise specified, materials shall be manufactured and supplied by one of the following:
  - .1 Benjamin-Moore
  - .3 Glidden/ICI
  - .4 Para Paints
  - .5 Pratt & Lambert
  - .6 Sherwin-Williams

#### 1.4 LIST OF MATERIALS, SAMPLES

- .1 List of Materials:
  - .1 Before ordering materials, submit written request in form acceptable to Consultant, for approval of paint materials. List each of the materials proposed and surfaces to be covered. State manufacturer's name and brand name of materials.
  - .2 List of materials shall be endorsed by manufacturer as being the best material for the applicable condition.
  - .3 Do not order material or commence work until list of materials is approved by Consultant.
- .2 Samples:
  - .1 Submit two 200 mm x 250 mm drawdowns of each paint colour coated with manufacturer's paint system to confirm colour match with colour chips supplied by Consultant.
  - .2 Submit sample of natural and stained finishes on each species and grade of wood to receive such finishes.
  - .3 Prepare full size samples showing each type of door finish.
  - .4 Prepare sample panels of each wall and ceiling paint system specified, as directed by Consultant.
- .3 Maintenance Materials:
  - .1 Upon completion of work provide one sealed and properly identified 1 L can of each type and colour paint used on this project.
  - .2 Only top coating paints used in building interior are required.

## **SECTION 09900 - PAINTING**

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### **1.5 PRODUCT HANDLING**

- .1 Deliver paint materials to site in sealed original labelled containers bearing manufacturer's name, brand name, type of paint and colour designation.
- .2 Store materials in strict accordance with manufacturer's recommendations.
- .3 Store paints, stains, varnishes, equipment in designated area inside building. Maintain separate workshop / storage area for duration of work by this Section.

### **1.6 JOB CONDITIONS**

- .1 Environmental Conditions:
  - .1 Maintain temperature in interior areas to receive coatings between 15°C and 25°C for at least 24 hours before, during application and until coatings have cured after application. Apply exterior coatings only when temperature is above 10°C.
  - .2 Do not apply exterior coatings during periods of precipitation nor when precipitation is imminent.
  - .3 Do not apply coatings under direct sunlight during hot weather.
  - .4 Adequately ventilate areas where coatings are being applied. Maintain a reasonably dust-free atmosphere for duration of work.
- .2 Protection:
  - .1 Protect adjacent surfaces not scheduled to receive coatings from damage.
  - .2 Remove electrical plates, surface hardware, fittings and fastenings prior to painting operations. These items shall be carefully stored, cleaned and replaced on completion of work in each area. No solvent shall be used to clean hardware that will remove permanent lacquer finish on these items.
  - .3 Mask labels and specification plates occurring on equipment to be painted.
  - .4 Post "wet coating" signs and "no smoking" signs while work is in progress and while coatings are curing.
  - .5 Keep oily rags, wastes and other combustible materials in closed metal containers and remove at end of each work day. Take every precaution to avoid spontaneous combustion.
- .3 Work Schedule:
  - .1 Unless otherwise permitted, apply coatings only after all other Sections have completed their work.
  - .2 Co-ordinate work of this Section with that of Section 07900 and review order of installation with Consultant where sealants are installed adjacent to painted surfaces.
  - .3 If it becomes necessary for the Owner to occupy areas of the building prior to their completion, schedule work of this Section to hours when occupants have vacated building.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Materials shall be "top line quality" products and shall be supplied by a single manufacturer except for specialty products not available from paint manufacturer.

## **SECTION 09900 - PAINTING**

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- .2 Materials shall be low odour and low VOC producing, emitting less than 150 g/L VOC for non flat paints and less than 50 g/L for flat paints and meet or exceed current Green Seal GS-11 standard.
- .3 Paints shall be factory mixed unless otherwise specified, except any coating in paste or powder form, or to be field-catalyzed shall be field-mixed in accordance with manufacturer's directions.
- .4 Primers shall be as specified by manufacturer and fully compatible with finish coats.
- .5 Stains shall be of the rapid dry, alkyd base type or pigment oil type.
- .6 Varnishes shall be synthetic type.
- .7 Shellac shall be pure white gum in pure grain alcohol.
- .8 Thinners, cleaners: as recommended by paint manufacturer.
- .9 Fire retardant wood treatment: tinted, water-based intumescent Class "A" fire retardant treatment: Fire Safe 108 Wood by Green Dolphin Systems Corp. Or equivalent product by other manufacturer approved by Consultant.

### **2.2 FINISHES**

- .1 Paint colours and other finishes will be selected by Consultant. Do not start work until after receiving colour schedule.
- .2 Colours selected by the Consultant will not necessarily be from manufacturer's standard colours.
- .3 A variety of colours may be used. Consultant may select different colours for different elements such as ductwork, bulkheads, exposed decks, slabs and structural steel. Include for up to 15 colours, not including mechanical room colours listed below. Of these colours, up to 50% may be deep tones.
- .4 Confirm gloss levels for all surfaces with Consultant before starting work. Unless otherwise indicated, allow:
  - .1 Walls: eggshell
  - .2 Ceilings: flat
  - .3 Frames, doors, trim: semi-gloss.
- .5 Paint exposed piping, ductwork and conduits in mechanical and boiler rooms in colours directed by Consultant.

## **PART 3 - EXECUTION**

### **3.1 CONDITIONS OF SUBSTRATES**

- .1 Sound, non-dusting, and free of grease, oil, dirt, and other matter detrimental to adhesion and appearance of coatings.
- .2 Temperature: minimum 13°C.
- .3 Moisture content: maximum 12%. Test for moisture content using moisture meter.
- .4 Alkalinity: test cementitious substrates for alkalinity. Use method recommended by coating manufacturer.

### **3.2 PREPARATION OF SUBSTRATES**

- .1 All substrates: clean as required to produce an acceptable surface. If wood, metal or any other surface to be finished cannot be put in proper condition for finishing by cleaning, sanding and filling as specified, notify Consultant in writing or assume responsibility for an rectify any unsatisfactory finish resulting.



## **SECTION 09900 - PAINTING**

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- .2 Wood generally: clean soiled surfaces; sand smooth and dust off; putty nail holes, splits, scratches, after prime coat has been applied and dried; colour putty to match finish; putty stained wood after stain application.
- .3 Wood for paint: clean knots, pitch streaks and sappy sections of residue and seal with sealer before applying prime coat.
- .4 Wood for transparent finish: clean knots, pitch streaks and sappy sections of residue and seal with white shellac; seal after applying stain. Apply filler to open grained woods, prior to application of stain unless directed otherwise by Consultant. Do not apply satin varnish coat until Consultant has inspected and approved gloss varnish coat.
- .5 Bare ferrous metal: remove rust and scale; wash with solvent; chemically clean; apply coat of metal primer.
- .6 Previously primed metal: remove rust, oil, grease and loose shop paint by washing or wire brushing; make good shop coat; feather out edges of touch-up.
- .7 Zinc coated metal: wash and etch to dull paint receptive surface using an approved crystalline zinc phosphate or vinyl pretreatment.
- .8 Hot dip galvanized steel: light brush blast.
- .9 Unit masonry & concrete: fill minor cracks, holes and fissures with Polyfilla and smooth to a flush surface. Texture filled areas to match surrounding surface.
- .10 Plaster: fill minor cracks, holes and fissures with patching plaster, allow to dry, smooth to a flush surface and texture filled area to match surrounding surface.
- .11 Gypsum board: fill minor cracks, holes and imperfections with patching plaster; allow to dry and sand smooth; sand taped joints and remove dust.
- .12 Alkaline surfaces: wash and neutralize using proper type of solution compatible with paint to be used.

### **3.3 BACK PRIMING**

- .1 Back prime wood schedule for paint or enamel finish immediately on arrival at site with interior or exterior primer as applicable.
- .2 Back prime wood scheduled for stain, varnish or natural finish immediately on arrival at site, with gloss varnish reduce 25% with mineral spirits.

### **3.4 APPLICATION OF COATINGS**

- .1 Apply paint by brush or roller, except on wood and metal surfaces where paint shall be applied by brush only.
- .2 Spray painting may be permitted where deemed advantageous and shall be subject to Consultant's approval. When spray painting is permitted, use only airless spray guns. Consultant may prohibit use of spray painting at any time for such reasons as carelessness, poor masking or protective measures, drifting paint fog, disturbance to other trades or failure to obtain a uniform satisfactory finish.
- .3 Applied and cured coatings shall be uniform in thickness, sheen, colour and texture and free of brush or roller marks, sags, crawls and other defects detrimental to appearance and performance.
- .4 Regardless of the number of coats specified for any surface, apply sufficient paint to completely cover and hide substrate and to produce a solid uniform appearance.
- .5 Thoroughly mix materials before application. Use same brand of paint for primer, intermediate and finish coats.

## **SECTION 09900 - PAINTING**

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- .6 Where two or more coats of same paint are to be applied, undercoats shall be tinted in lighter shades of final coat to differentiate from final coat.
- .7 Touch up suction spots after application of first coat. Sand lightly between coats with fine sandpaper.
- .8 Each coat of finish shall be dry and hard before succeeding coats are applied with a minimum of 24 hours between coats, unless manufacturer's instructions state otherwise. Do not proceed with any coat until the last proceeding coat is approved by the Consultant.
- .9 Stained woodwork shall be covered with a uniform coat of stain and wiped off if required. Wood shall have uniform shade. Match stain so that dissimilar woods have uniform finished appearance.

### **3.5 PATCHING / TOUCH-UP**

- .1 Prior to takeover of project by Owner, inspect work of this Section and touch-up or refinish damaged finishes and finishes unsatisfactory to Consultant.

### **3.6 SCHEDULE OF FINISHES**

- .1 General Requirements:
  - .1 Paint or otherwise finish surfaces of building materials, building services and building accessories not otherwise protected or covered, as shown on Room Finish and Door Schedule, Drawings and as specified herein.
  - .2 In addition to finishing required by Room Finish and Door Schedules, Drawings and these Specifications, and unless otherwise specified, all work which is exposed to view and which is not prefinished shall be finished by this Section.
  - .3 In areas specifically designated as "unfinished" painting is not required except for bare, primed and zinc coated metal surfaces and insulated ductwork and pipes.
  - .4 Where exposed to view paint bare metals, previously primed metals and zinc coated metals unless specified otherwise.
  - .5 Paint behind surface mounted fixtures on walls and ceilings with full coats of paint.
  - .6 Paint walls behind wall mounted heating units with full coats of paint.
  - .7 Paint inside surfaces of light coves white.
  - .8 Finish tops of doors, trim, projections and other work as specified for surrounding work whether above site lines or not.
  - .9 Finish edges of doors to match face of door. Refinish edges of doors after fitting.
  - .10 Finish drawers on all sides, inside and outside. Unless otherwise indicated finish drawers with two coats of varnish.
  - .11 Paint tops, bottoms and edges of shelves with full specified coats, whether exposed to view or not.
  - .12 Paint interior of ducts at grilles and diffusers with two coats of flat black paint, so that duct interior is not visible when grilles and diffusers are installed.
  - .13 Paint piping, ducts and conduits in colours matching background wall or ceiling colours, unless otherwise directed by the Consultant. Ducts in mechanical rooms require only one finish coat in addition to primer. Other exposed ductwork to receive two finish coats.
  - .14 Paint all gas piping whether exposed to view or not, with high-visibility yellow-orange paint meeting CGSB Colour Code #1-GP-12, Code 505-101 or equal.

## SECTION 09900 - PAINTING

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- .15 Unless specifically indicated to be painted, all finish carpentry work shall receive transparent finish.
  - .16 Unless specifically indicated otherwise paint all rooftop equipment and components, regardless of material and finish, including but not necessarily limited to mechanical rooftop equipment, vent stack flashings, sleeve flashings window washing anchors, but not including prefinished sheet steel flashings.
  - .17 Where finishing formula for surfaces requiring painting is not included hereunder, follow recommendations of Canadian Painting Contractor's Association Architectural Painting Specification Manual, latest issue.
- .2 Interior Finishing:
- .1 Concrete and concrete block:
    - 2 coats block filler
    - 1 coat primer, latex or PVA based
    - 2 coats acrylic latex
  - .2 Metal, prime painted:
    - spot prime with alkyd metal primer
    - 2 coats acrylic latex
  - .3 Metal, zinc coated:
    - 1 coat galvanized primer
    - 2 coats acrylic latex
  - .4 Woodwork, painted:
    - 1 coat alkyd enamel undercoat
    - 2 coats acrylic latex
  - .5 Woodwork, stained and varnished (transparent finish):
    - 1 coat stain
    - 1 coat sanding sealer, sand lightly
    - 1 coat alkyd or polyurethane varnish, gloss
    - 1 coat alkyd or polyurethane varnish, satin
  - .6 Gypsum board:
    - 1 coat drywall primer
    - 2 coats acrylic latex
  - .7 Exposed piping, wrapped:
    - 1 coat block filler
    - 2 coats acrylic latex
  - .8 Exposed piping and conduit, unwrapped:
    - 1 coat alkyd metal primer
    - 2 coats acrylic latex
  - .9 Exposed ductwork, insulated:
    - 1 coat block filler and primer
    - 2 coats acrylic latex
- .3 Exterior Finishing:
- .1 Metal, zinc coated (hot dip galvanized):
    - 1 coat epoxy primer
    - 2 coats aliphatic polyurethane
  - .2 Metal, zinc coated (inorganic zinc rich primer):
    - 1 coat epoxy primer
    - 2 coats aliphatic polyurethane

**SECTION 09900 - PAINTING**

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- .3 Wood:  
2 coats solid colour stain

**END**

## **SECTION 10001 - MISCELLANEOUS SPECIALTIES**

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### **PART 1 - GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Conform with Sections of Division 1 as applicable to the Work of this Section.
- .2 Submit shop drawings in accordance with Section 1007.
- .3 Base bid is to include the manufacturers products specified. Provide alternate quotations from other manufacturers and list on tender form.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- .1 Steel: to CAN-G40.21-M81, Grade W.
- .2 Stainless Steel: to CSA G110.6-1986 Type 302, No. 4 finish.
- .3 Sheet Steel: to ASTM A366-72 stretcher levelled or tempered rolled.
- .4 Baked Enamel: 1 coat metal conditioner to CGSB 31-GP-197a; 1 coat primer to CGSB 1-GP-81e Type 2; 2 coats enamel to CGSB-1-GP-88e, baked to hard durable finish.
- .5 Aluminium Sections: Extruded from AA6063-T5 alloy.

### **PART 3 - INSTALLATION**

#### **3.1 INSTALLATION**

- .1 Supply templates, components and instructions for items built into work of other sections.
- .2 Install items plumb, straight and level.
- .3 Securely fix items in place with concealed fasteners, unless noted otherwise, all to be theft and corrosion resistant.
- .4 Install items and equipment strictly according to approved shop drawings and manufacturer's recommendations.
- .5 Install all items noted as "supplied by Owner".

### **PART 4 - FABRICATION & EQUIPMENT**

#### **4.1**

- .1 Mailboxes: Canadian Mailbox Company, S104 Front loading, 3 boxes wide x 5 boxes high, all complete with individual 5 pin tumbler locks and trim.

## **SECTION 10001 - MISCELLANEOUS SPECIALTIES**

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- .2     Access Ladder: Global Industrial, 19 step steel caged walk through fixed access ladder #WLFC1219, 460 mm x 19 mm solid steel rungs spaced 300 mm apart, 64 mm x 9 mm flat steel side rails with 178 mm standoff brackets, all welded construction.

**END**

## **SECTION 10165 - METAL TOILET PARTITIONS**

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### **PART 1 - GENERAL**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Comply with requirements of Division 1.

#### **1.2 RELATED WORK**

- .1 Washroom accessories: Section 10800

#### **1.3 QUALITY ASSURANCE**

- .1 Stalls for handicapped shall meet regulatory requirements for barrier free access.

#### **1.4 SAMPLES**

- .1 Upon Consultant's request, submit a reduced size sample of a door and pilaster assembly, complete with all hardware and anchorage devices.

#### **1.5 SHOP DRAWINGS**

- .1 Submit detailed shop drawings.
- .2 Clearly indicate fabrication details, plans, elevations, hardware, and installation details.

#### **1.6 PROTECTION**

- .1 Protect finished surfaces during shipment and installation by approved means. Protect surfaces until Substantial Performance.

#### **1.7 WARRANTY**

- .1 At no cost to Owner, remedy any defects in work of this Section due to delamination and warping of plastic laminate components for a period of 2 years from date of Substantial Performance.

### **PART 2 - PRODUCTS**

#### **2.1 SYSTEM**

- .1 Partition System: Floor mounted overhead braced Powder Coated Metal type by one of the following manufacturers:
  - .1 Bobrick
  - .2 General Storage Systems
  - .3 Global
  - .4 Ampco
  - .5 Saferail

#### **2.2 MATERIALS**

- .1 Doors to be 25 mm thick, 22 gauge galvanized stretcher levelled quality steel formed and bonded under pressure with a non toxic adhesive to a resin-impregnated honeycomb core. Consultant will select colours. Up to 4 colours may be used.
- .2 Pilasters to be 32 mm thick, 22 gauge galvanized stretcher levelled quality steel formed and bonded under pressure with a non toxic adhesive to a resin-impregnated honeycomb core. Consultant will select colours. Up to 4 colours may be used.
- .3 Stainless steel sheet metal: to ASTM A666, type 302 or 304 with No. 4 finish.
- .4 Hardware: through bolted type, fabricated of satin finish type 304 stainless steel:

## **SECTION 10165 - METAL TOILET PARTITIONS**

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- .1 Hinges: self-closing type, adjustable to hold door open at any angle up to 90°.
- .2 Slide bolt and keeper: equipped for emergency access.
- .3 Door stop: with rubber insert.
- .4 Wall and connecting brackets: stainless steel.
- .5 Door pull: D-pull for outswinging doors.
- .5 Overhead brace: extruded aluminum channel with colour anodized finish and anti-grip design.
- .6 Fasteners: stainless steel tamperproof one-way type screws and bolts.
- .7 Sealer: water resistant sealer acceptable to laminate manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 PARTITION ERECTION**

- .1 Install partitions secure, plumb and square.
- .2 Attach pilasters to floor with pilaster supports and level, plumb, and tighten installation with levelling device. Provide for adjustment of flooring variations with screw jack through steel saddles made integral with pilaster.
- .3 Secure pilaster shoes in position.
- .4 Set doors in closed position level with panels, parallel with overhead brace.
- .5 Leave maximum 12 mm space between wall and panel or end pilaster. Leave maximum 3 mm space between doors and pilasters.
- .6 Attach wall brackets securely to solid masonry and concrete walls using screws, and shields to hollow walls using bolts and toggle type anchors. Ensure suitable mounting plates, brackets or solid blocking are in place and securely anchored at gypsum board partitions. Provide minimum 3 brackets per pilaster/panel edge to be anchored.
- .7 Attach panel and pilaster to brackets with through type sleeve bolt and nut. Provide minimum 3 bracket per panel height.
- .8 Equip each door with hinges and latch set. Adjust and align hardware for easy, proper function. Set door open position at 30° to front. Provide door stop at each door.
- .9 Equip outswinging doors with door pulls inside and outside, and wall or door bumper outside.

**END**



## SECTION 10800 - WASHROOM ACCESSORIES

---

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- .1 Refer to Division 1

#### 1.2 RELATED WORK

- .1 Toilet partitions: Section 10165
- .2 Electric power for hand and hair dryers: Division 16

#### 1.3 SHOP DRAWINGS

- .1 Submit manufacturer's catalogue cut of each component required.
- .2 Submit a washroom accessories schedule indicating all accessories required, on a room by room basis, showing model number, finish and mounting height.

#### 1.4 WARRANTY

- .1 At no cost to Owner, replace mirrors should defects in silvering occur within a period of 5 years from date of Substantial Performance.

### PART 2 - PRODUCTS

#### 2.1 FABRICATION - GENERAL

- .1 Fabricate work true to dimensions, square and plumb.
- .2 Thickness of metal shall be adequate for the various conditions, and intended uses.
- .3 Finished work shall be free from warping, open seams, weld marks, rattles and other defects. Drilling shall be reamed and exposed edges finished smooth.
- .4 Fastenings shall be concealed or theft proof type where possible. Exposed fastenings shall be neatly executed and shall be of the same material and finish as the base metal on which they occur.
- .5 Accessories required, in each case, are specified by a reference to a particular product by one manufacturer. The products listed shall serve to establish a standard of acceptance. Accessories of the same materials, construction and finishes, similar in function, design appearance and conforming to the standard of those specified, manufactured by the following are acceptable:
  - .1 Bobrick
  - .2 Bradley
  - .3 Frost
  - .4 Watrous

#### 2.2 WASHROOM ACCESSORIES

- .1 Toilet paper dispenser (TPD-A): Frost #1135-S single roll dispenser.
- .2 Toilet paper dispenser (TPD-B): San Jamar, 9" JBT Oceans Dispenser #R2090TBK.
- .3 Paper towel dispenser (PTD): NPS Corp., Response HRT Lever dispenser, hard roll towels up to 8" dia.
- .4 Hand dryer (HD): ASI Model # 0185, 115 V, Surface mounted, one piece 16 ga. steel cover with white enamel finish, infra red sensor, fixed directional air vanes.

## **SECTION 10800 - WASHROOM ACCESSORIES**

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- .5 Mirrors: No. 1 quality, 6 mm thick glass mirror, heavy galvanized steel back; stainless steel frame with mitred corners, tamperproof mounting.
  - .1 Mirror (MR.1): Frost 941-1830, 18" x 30" metal framed mirror, vandal resistant mounting.
- .6 Robe hook (RH): Frost 1138-S, heavy duty, stainless steel, concealed mounting.
- .7 Grab bars (GB): Frost, 1 ½" diameter, stainless steel, satin finish, concealed mounting, meeting requirements of OBC and as follows:
  - .1 GB1: 1001-NP-24" straight
  - .2 GB2: 1003-NP-30 X 30" L-shaped

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install components including Owner supplied items at locations shown. Where location is not given install as directed by Consultant.
- .2 Fastenings shall be non-corrosive type.
- .3 Provide mounting and anchorage devices to be built into walls and other construction elements as required to securely anchor components in place.
- .4 Securely anchor components in place. Method of fastenings shall ensure that components will be capable of withstanding expected loads without movement.
- .5 Install mirrors with concealed wall hangers and lock in place with theft proof screws.
- .6 Insulate accessory surfaces to prevent electrolysis due to contact with dissimilar metal surfaces. Use bituminous paint or other approved means.

#### **3.2 CLEANING AND ADJUSTMENT**

- .1 Upon completion of work or when directed, remove all traces of protective coatings or paper.
- .2 Test mechanisms, hinges, locks and latches and where necessary, adjust and lubricate and ensure that accessories are in perfect working order.

#### **3.3 SCHEDULE**

- .1 Unless otherwise shown:
  - .1 Install toilet paper dispenser at each WC.
  - .2 Provide paper towel dispenser at each washroom.
  - .3 Provide framed mirror at each washroom, in location shown; where no location shown, install above lavatory.
  - .4 Provide mirrors as indicated.
  - .5 Provide grab bars at WC's for barrier free access.
  - .6 Provide robe hook at toilet stalls and where shown.
  - .7 Install soap dispenser at each lavatory.

**END**

## **SECTION 15001 – LIST OF CONTENTS**

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### **DIVISION 15**

### **MECHANICAL**

|               |   |
|---------------|---|
| SECTION 15002 | FORM OF SUPPLEMENTARY MECHANICAL TENDER |
| SECTION 15010 | MECHANICAL WORK GENERAL INSTRUCTIONS    |
| SECTION 15050 | MECHANICAL BASIC MATERIALS AND METHODS  |
| SECTION 15250 | INSULATION                              |
| SECTION 15400 | PLUMBING SYSTEMS                        |
| SECTION 15450 | PLUMBING FIXTURES AND FITTINGS          |
| SECTION 15500 | FIRE PROTECTION                         |
| SECTION 15600 | POWER AND HEAT GENERATION               |
| SECTION 15850 | AIR HANDLING                            |
| SECTION 15880 | AIR DISTRIBUTION                        |
| SECTION 15890 | TESTING, ADJUSTING AND BALANCING        |

**END OF SECTION**

**SECTION 15002 - FORM OF SUPPLEMENTARY MECHANICAL TENDER**

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NAME OF BIDDING SUBCONTRACTOR: \_\_\_\_\_

DATE: \_\_\_\_\_

PROJECT:           **ROSEDALE RENOVATIONS  
FOR SSM HOUSING  
90 CHAPPLE AVE  
SAULT STE. MARIE, ONTARIO**

To:                   MGP Architects + Engineer Inc.  
Floor 2 – 123 East Street,  
Sault Ste Marie, Ontario  
P6A 3C7

Attn:    Mr. Elio Principe ([eprincipe@mgp-arch-eng.ca](mailto:eprincipe@mgp-arch-eng.ca))

Submit document in accordance with Document 00200 - Instructions to Bidders and submit a copy directly to MGP Architects Engineer Inc. by means of e-mail addressed as above, within 4 hours after the Bid closing.

Note: The Specifications shall govern over this list. Where names are added/deleted by addenda, it shall be understood that this list will reflect the respective changes. Failure to complete and submit this document as directed may result in your Bid being ruled informal.

**DIVISION 15 LIST OF MANUFACTURERS/SUPPLIERS**

We submit, herein, typed or neatly printed, the names of the manufacturers upon whose products our Bid Price is based. If no name is indicated, or if more than one name is indicated for a particular product, we are prepared to provide the base specified manufacturer's product. Where products are named in the specifications with only one (1) manufacturer/supplier, or are not listed herein, we are also prepared to provide the base specified named product. We will provide Canadian manufactured products if costs and quality are similar.

We understand that the first manufacturer specified for any product is the manufacturer upon whose product the design is based, and that the other manufacturers specified for a particular product are manufacturers acceptable to the Owner and whose product produces equivalent quality, performance and size. We further understand if we indicate a manufacturer other than the manufacturer whose product is the basis of the design, we are responsible for ensuring that the product supplied is equivalent in quality, performance and size to the base design product, and that any additional costs incurred as a result of use of such products will be borne by us.

Acceptance of non base specified manufacturers with respect to their equivalency shall be subject to the Owner's review of shop drawings.

CONTRACTOR'S AUTHORIZED SIGNATURE \_\_\_\_\_

**SECTION 15002 - FORM OF SUPPLEMENTARY MECHANICAL TENDER**

| SECTION | PRODUCT                                 | MANUFACTURER/SUPPLIER & CATALOGUE NUMBER |
|---------|---|--|
| 15050   | Gate, Globe and Swing Type Check Valves |  |
| 15050   | Ball Valves                             |  |
| 15050   | Butterfly Valves                        |  |
| 15050   | Motor Control Centres & Starters        |  |
| 15050   | Vibration Isolation                     |  |
| 15050   | Variable Frequency Drives               |  |
| 15250   | Fibreglass Insulation                   |  |
| 15250   | Flexible Elastomeric Insulation         |  |
| 15400   | Drains                                  |  |
| 15450   | Vitreous China Fixtures                 |  |
| 15450   | Stainless Steel Sinks                   |  |
| 15450   | Shower Fittings                         |  |
| 15450   | Emergency Eye Washes                    |  |
| 15450   | Mop Sinks                               |  |
| 15450   | Flush Valves                            |  |
| 15450   | Fixture Carriers                        |  |
| 15450   | Wash Fountains                          |  |
|         |   |  |
| 15450   | Hose Bibs                               |  |
| 15450   | Trap Seal Primer                        |  |
| 15450   | Mixing Valves                           |  |
| 15500   | Fire Extinguisher                       |  |
| 15500   | Sprinkler Heads                         |  |
| 15500   | Excess Pressure Pump and Control Panel  |  |
| 15600   | Hot Water Boilers                       |  |
| 15600   | Gas Fired Domestic Water Heaters        |  |
| 15650   | Roof Mounted Condensing Units           |  |
| 15650   | Split Air Conditioning Units            |  |
| 15700   | Expansion Tanks                         |  |
| 15700   | Air Separators                          |  |
| 15700   | Chemical Treatment                      |  |
| 15700   | Circulating Pumps                       |  |
| 15700   | Variable Speed Pumping System           |  |
| 15700   | Plate Type Heat Exchangers              |  |
| 15700   | Circuit Balancing Valves                |  |
| 15700   | Unit Heaters                            |  |
| 15700   | Cabinet Heaters                         |  |

CONTRACTOR'S AUTHORIZED SIGNATURE \_\_\_\_\_

**SECTION 15002 - FORM OF SUPPLEMENTARY MECHANICAL TENDER**

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| <b>SECTION</b> | <b>PRODUCT</b>                                  | <b>MANUFACTURER/SUPPLIER &amp; CATALOGUE NUMBER</b> |
|----------------|---|---|
| 15700          | Direct Radiation Units (Wall Fin Convectors)    |   |
| 15700          | Direct Radiation Units (Radiators)              |   |
|                |   |   |
| 15700          | Radiant Floor Heating                           |   |
| 15850          | Air Handling Units                              |   |
| 15850          | Rooftop Units                                   |   |
| 15850          | Energy Recovery Ventilator Units                |   |
| 15850          | Centrifugal Fans                                |   |
| 15850          | In-Line Fans                                    |   |
| 15850          | Propeller Fans                                  |   |
| 15850          | Range Hoods                                     |   |
|                |   |   |
| 15850          | Roof Mounted Fans                               |   |
| 15850          | Paddle Wheels Fans                              |   |
| 15850          | Air Filters                                     |   |
| 15850          | Air Filter Gauges                               |   |
| 15880          | Fusible Link Fire Dampers                       |   |
| 15880          | Grilles and Diffusers                           |   |
| 15880          | Motorized Dampers                               |   |
| 15880          | Silencers                                       |   |
| 15880          | Terminal Units                                  |   |
| 15900          | Control Damper Operators                        |   |
| 15900          | Automatic Control Valves                        |   |
| 15900          | Control Valve Operators                         |   |
| 15900          | Central Direct Digital Control System Equipment |   |

**END OF SECTION 15002**

CONTRACTOR'S AUTHORIZED SIGNATURE \_\_\_\_\_

## **SECTION 15010 – MECHANICAL WORK GENERAL INSTRUCTIONS**

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- 1.2 APPLICATION
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- 1.8 WORK STANDARDS
- 1.9 PERMITS, CERTIFICATES AND FEES
- 1.10 CHANGES OR REVISIONS TO THE WORK
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- 1.13 TRIAL USAGE
- 1.14 RECORD (AS-BUILT) DRAWINGS
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- 1.16 WARRANTY
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- 1.19 BREAKDOWN OF MECHANICAL WORK COST
- 1.20 SUB-CONTRACTORS TO THE MECHANICAL CONTRACTOR
- 1.21 ENERGY EFFICIENCY OF PRODUCTS

#### **PART 2 - PRODUCTS**

NIL

#### **PART 3 - EXECUTION**

NIL

## SECTION 15010 – MECHANICAL WORK GENERAL INSTRUCTIONS

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### PART 1 - GENERAL

#### 1.1 REFERENCES

- .1 The "General Conditions," the "Supplementary Conditions" and all Sections of Division 1 apply to and are a part of this Section of the Specification.

#### 1.2 APPLICATION

- .1 This Section applies to and is an integral part of all Sections of Division 15 of the Specification.

#### 1.3 DEFINITIONS

- .1 The following are definitions of words found in Sections of Division 15 of the Specification and on associated drawings:
  - .1 "concealed" - means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions;
  - .2 "exposed" - means work normally visible, including work in equipment rooms, tunnels, and similar spaces;
  - .3 "provide" (and tenses of "provide") - means supply and install complete;
  - .4 "install" (and tenses of "install") - means secure in position and connect complete;
  - .5 "supply" - means supply only;

#### 1.4 EXAMINATION OF SITE

- .1 Carefully examine all conditions at the site that will or may affect mechanical work, and become familiar with site conditions, the building construction, finishes, and work associated with mechanical work in order that your Bid Price includes for everything necessary for completion of the mechanical work.

#### 1.5 PLANNING AND LAYOUT OF WORK

- .1 The exact locations and routing of mechanical and electrical services shall be properly planned, coordinated and established with all affected trades prior to installation such that the services will clear each other as well as any obstructions. Generally, give the right of way to piping requiring uniform pitch and locate and arrange other services to suit.
- .2 Prepare working detail drawings, supplementary to the contract drawings, when deemed necessary by the Consultant, for all areas where a multiplicity of services and/or equipment occur, or where the work due to architectural and structural considerations involves special study and treatment. Submit working detail drawings to the Consultant in shop drawing form for review before the affected work is installed.
- .3 Carry out all alterations in the arrangement of work that has been installed without proper co-ordination, study, and review, even if in accordance with the contract documents, in order to conceal the work behind finishes, or to allow the installation of other work, without additional cost. In addition, make any alterations necessary in other work required by such alterations, without additional cost.

#### 1.6 DOCUMENTS

- .1 The drawings and Specification are intended to be co-operative. Perform all work that is shown, specified or reasonably implied on the drawings but not mentioned in the Specification, or vice-versa, as though fully covered by both. When the scale and date of the drawings are the same, or when the discrepancy exists within the Specification, include the most costly arrangement. In the case of discrepancies or conflicts between the drawings and Specification, the documents will govern in the following order:
  - .1 the Specification;



## SECTION 15010 – MECHANICAL WORK GENERAL INSTRUCTIONS

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- .2 detail drawings;
  - .3 flow diagrams;
  - .4 drawings of larger scale;
  - .5 drawings of smaller scale;
  - .6 drawings of later date when the scale of the drawings is the same.
- .2 The Specification is arranged in accordance with the CSI/CSC 16 Division Format. Sections of Division 15 are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and the Sections shall be read as a whole.
  - .3 The mechanical drawings are performance drawings, diagrammatic, and show approximate locations of equipment and materials. The drawings are intended to convey the scope of work and do not show architectural and structural details. The locations of materials and equipment shown may be altered, when reviewed by the Consultant, to meet requirements of the material and/or equipment, other equipment and systems being installed, and of the building. Provide all fittings, offsets, transformations, and similar items required as a result of obstructions and other architectural or structural details but not shown on the mechanical drawings.
  - .4 The Specification does not generally indicate the specific number of items or amounts of material required. The Specification is intended to provide product data and installation requirements. It is necessary to refer to schedules, drawings (layouts, riser diagrams, schematics, details) and the Specification to determine correct quantities. In Division 15 of the Specification, singular may be read as plural, and vice-versa.
  - .5 The drawings and specifications are prepared solely for use by the party with whom the Consultant has entered into a contract and there are no representations of any kind made by the Consultant to any party with whom the Consultant has not entered into a contract.

### 1.7 SHOP DRAWINGS

- .1 Submit for review, properly identified and dimensioned shop drawings showing in detail the design, construction and performance of equipment and materials as requested in Sections of Division 15 of the Specification.
- .2 Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS," include your company name, the submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned for resubmittal. The number of copies of shop drawings shall be ten (10).
- .3 The Consultant will review shop drawings and will indicate his review status by stamping shop drawing copies as follows:
  - .1 "REVIEWED" or "REVIEWED AS NOTED" - If the Consultant's review of shop drawing is final, the Consultant will stamp the shop drawing "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked);
  - .2 "REVISED & RESUBMIT" - If the Consultant's review of shop drawing is not final, the Consultant will stamp the shop drawing "REVISED & RESUBMIT," mark the submission with his comments, and return the submission. Revise the shop drawing in accordance with the Consultant's notations and resubmit.
- .4 It is understood that the following shall be read in conjunction with the wording on the Consultant's shop drawing review stamp applied to each and every shop drawing submitted:

## **SECTION 15010 – MECHANICAL WORK GENERAL INSTRUCTIONS**

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“THIS REVIEW BY MGP ARCHITECTS \* ENGINEER INC IS FOR THE SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH THE GENERAL DESIGN CONCEPT FOR ARCHITECTURAL FEATURES ONLY AND DOES NOT IN ANY WAY CONSTITUTE REVIEW OF THE DESIGN OF ENGINEERING ELEMENTS WHICH FORM PART OF THE CONTRACT DOCUMENTS PREPARED BY OTHERS. THIS REVIEW SHALL NOT MEAN THE MGP ARCHITECTS \* ENGINEER INC APPROVES THE DETAIL DESIGN INHERENT IN THE SHOP DRAWINGS, RESPONSIBILITY FOR WHICH SHALL REMAINS WITH THE CONTRACTOR SUBMITTING THE SAME, AND SUCH REVIEW SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY FOR MEETING ALL REQUIREMENTS OF THE CONTRACT DOCUMENTS. THE CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT THE JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATIONS PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR CO-ORDINATION OF THE WORK OF ALL SUBTRADES.”

### **1.8 WORK STANDARDS**

- .1 Where regulatory codes, standards and regulations are at variance with the drawings and Specification, the more stringent requirement will apply.
- .2 Where any code, regulation, by-law or standard is quoted it means, unless otherwise specifically noted, the current edition including all revisions or amendments at the time of the contract. Where references are made to printed instructions, it means the current edition of such instructions.

### **1.9 PERMITS, CERTIFICATES AND FEES**

- .1 Obtain and pay for all permits required to complete mechanical work.
- .2 Include in each copy of operating and maintenance instruction manuals, copies of inspection certificates issued by governing authorities to certify that the completed work is in accordance with the regulations of the governing authorities and is acceptable to them.

### **1.10 CHANGES OR REVISIONS TO THE WORK**

- .1 Wherever the Consultant proposes in writing to make a change or revision to the design, arrangement, quantity or type of any work from that called for on or in the contract documents, submit to the Consultant for approval, a detailed, itemized, estimate breakdown of the cost of all equipment, materials and labour entering into each change or revision.
- .2 Do not execute any changes or revisions until written authorization for such changes or revisions has been issued by the Consultant.
- .3 Note: For any revision which includes deleted work as well as additional work, the total cost of the deleted work must be subtracted from the cost of the additional work before adding percentages for overhead and profit.

### **1.11 CLEANING UP**

- .1 During construction, and on a daily basis, keep the site reasonably clear of rubbish and waste material resulting from mechanical work to the satisfaction of the Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove all of your rubbish and debris, and arrange for and pay for the repair of any damage caused as a result of mechanical work.

### **1.12 PROTECTION OF EQUIPMENT AND MATERIALS**

- .1 Properly protect all mechanical equipment and materials on site from damage due to the elements, the mechanical work and the work of other trades, to the satisfaction of the Consultant. All equipment and materials must be in new condition when the work is substantially performed.
- .2 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so that equipment is delivered to the site when it is required, or so that it can be stored within the building and protected from the elements.

## SECTION 15010 – MECHANICAL WORK GENERAL INSTRUCTIONS

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### 1.13 TRIAL USAGE

- .1 The Consultant reserves the right to use any piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same before final completion and acceptance of the work. Such tests are not to be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the equipment and/or materials due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials and/or workmanship of any kind. Supply all labour and equipment required for such tests.

### 1.14 RECORD (AS-BUILT) DRAWINGS

- .1 The drawings for this project have been prepared on a CAD system using AutoCAD Release 2007 software. For the purpose of producing record “as-built” drawings, copies of contract drawings may be purchased from the Engineer, at the Contractor’s expense of \$25.00 CDN plus GST, per drawing, up to the first ten (10) drawings and \$5.00 CDN plus GST, per drawing for all additional drawings.
- .2 When work begins at the site, clearly and accurately mark on a bound set of white prints of the contract drawings, on a daily basis, all changes and deviations from the routing of piping and ductwork and locations of equipment shown on the contract drawings. Changes and deviations include those made by addenda, change orders, and site instructions, and changes and deviations indicated on supplemental drawings issued with addenda, change orders, and site instructions. Maintain the “as-built” white prints at the site for periodic inspection by the Consultant throughout the duration of the work.
- .3 Pay particular attention to accurately dimension the location of all concealed services terminated for future extension, all buried work and services and work concealed within the building in inaccessible locations.
- .4 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of the Contract Document drawing set in accordance with the marked-up set of “as-built” white prints including all deviations from original Contract Document drawings, thus forming an “as-built” drawing disk set. Submit the “as-built” site drawing prints, to the Consultant for review. Make necessary revisions to drawings to the satisfaction of the Consultant.
- .5 Use the final reviewed “as-built” drawing set to provide CAD files of the drawings and reproducible mylar drawing set thus forming true “as-built” set of contract drawings. Convert the final CAD drawing files to PDF files either by software or by scanning the hardcopies. Load both CAD drawing files and PDF files onto compact discs (CD’s). Provide two complete sets of as-built drawings on CD’s. Submit the “as-built” sets of white prints, mylar prints and discs to Consultant.
- .6 All submitted drawings shall be of the same quality as original contract drawings. The CAD drawings shall be of the form compatible to the existing AutoCad software.

### 1.15 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

- .1 For each item of equipment for which a shop drawing is required (except for drains, plumbing fixtures and trim, and similar simple equipment), supply three (3), specific, indexed copies of equipment manufacturer’s operating and maintenance instruction data manuals. Consolidate each copy of the data in an identified hard cover three-ring binder. Each binder shall include:
  - .1 a copy of each “reviewed” shop drawing;
  - .2 complete explanation of operation principles and sequences;
  - .3 complete part lists with numbers;
  - .4 recommended maintenance practices and precautions;
  - .5 copies of all inspection certificates issued by regulatory authorities, including pressure vessel inspection certificates;
  - .6 complete wiring and connection diagrams;

## SECTION 15010 – MECHANICAL WORK GENERAL INSTRUCTIONS

- .7 a copy of each valve tag chart;
  - .8 a copy of the mechanical systems testing and balancing reports.
  - .9 a compact disc (CD) with the above mentioned documents in PDF format.
- .2 Submit the operating and maintenance instruction manuals to the Consultant before applying for a Certificate of Substantial Performance of the Work.
  - .3 When shop drawings are returned to you marked "REVIEWED AS NOTED" with revisions marked on the shop drawing copies, such shop drawings shall be revised by the equipment supplier to incorporate the comments marked on the "reviewed" shop drawings and a clean updated copy is to be included in the operating and maintenance manual.

### 1.16 WARRANTY

- .1 Unless otherwise noted, warrant the mechanical work to be in strict accordance with the contract documents and free from defects for a period of 1 year from the date of issue of a Certificate of Substantial Performance of the Work.
- .2 Repair and/or replace any defects that appear in mechanical work within the warranty period, ordinary wear and tear and wilful damage by or carelessness of the Owner's staff or agents excepted, without additional expense to the Owner. Where such defects occur, be responsible for all costs incurred in making the defective work good, including repair or replacement of building finishes, other materials, or damage to other equipment caused by such defects, or by subsequent replacement and repairs.
- .3 All warranties shall commence from the time of substantial completion, regardless of what is noted within the following sections of the specification. "Drop Date" type warranties are not acceptable. Warranty work shall be performed by the equipment manufacturer and not by the Contractor. The Contractor shall be responsible for retaining the equipment manufacturer to provide whatever "bridging" or additional extended warranty period is required from the time that the material is purchased until the time of substantial completion.
- .4 The following table indicates the warranty period that shall be provided for the following equipment

| Equipment                     | Items   | Warranty |
|-------------------------------|---|----------|
| Hot Water Heater              | Boilers, Pumps, Burners, Frequency Drives, Heat Exchangers, Chemicals, Cabinet and Unit Heaters   | 2 year   |
| Water Treatment               |   | 1 year   |
| Air Handling Units (AHU)/ MUA | Fans, Motors, Coils Drives, Dampers, Exhaust Fans, VAV Boxes, Dump Boxes, Fan Power Boxes, Cabinets, and Frequency Drives(Supplied by different supplier) | 1 year   |
| Rooftop Units (RTU)           |   | 1 year   |
| DX Cooling Equipment          | Compressors, coils, fans, valves, heaters, etc.   | 2 year   |
| Controls                      |   | 3 year   |

- .5 The Owner reserves the right to initiate a service contract for all equipment with one of Owner's approved certified service companies. This shall not affect any of the above extended warranties provided by the manufactures.

## SECTION 15010 – MECHANICAL WORK GENERAL INSTRUCTIONS

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### 1.17 EQUIPMENT AND MATERIALS

- .1 Provide Canadian manufactured products wherever possible and where required quality and performance is obtainable. Unless otherwise specified, all materials and apparatus shall be new and shall comply with applicable Canadian Standards Association (CSA) Standards and/or Underwriters Laboratories of Canada (ULC) Standards and the requirements of the authorities having jurisdiction. Unless otherwise specified, similar products i.e.: all valves, all control components, all vibration isolation, etc., shall be the product of one (1) manufacturer.
- .2 Materials and equipment scheduled and/or specified, have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for material and equipment, specified by manufacturer's name and model number. Unless otherwise noted, the Bid Price may be based on materials and equipment supplied by any of the manufacturers named as acceptable for the particular material or equipment. If acceptable manufacturers are not stated for a particular material or piece of equipment, base the Bid Price on material supplied by the base specified manufacturers.
- .3 If materials or equipment supplied by a manufacturer named as acceptable are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in quality, performance and operating characteristics (including energy consumption if applicable) to the specified materials or equipment, and, it shall be understood that any additional costs, and changes to associated or adjacent work resulting from provision of materials supplied by a manufacturer other than the specified manufacturer is included in the Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of specified equipment and the dimensions of such equipment differs from the specified equipment, prepare and submit for review, accurately dimensioned layouts of rooms affected.
- .4 In addition to the manufacturers specified or named as acceptable, other manufacturers of materials or equipment may be proposed to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the Bid Price must be based on equipment or materials specified or named as acceptable. Certify in writing to the Consultant that the proposed alternative meets all space, power, design, energy consumption, and all other requirements of the specified or acceptable material or equipment. In addition, it shall be understood that there will be no increase in the contract Price by reason of any changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives. The Consultant has sole discretion in accepting any such proposed alternative material or equipment.
- .5 Where products you intend to provide are proposed as "an equal" and/or "or approved equal," to specified products, certify in writing that the proposed product to be used in lieu of specified product, at least meets space, power, design, energy consumption, noise criteria and other requirements of the specified product and thus shall be equivalent to or better than the specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or equal" and/or "or approved equal" products shall be at the sole discretion of the Consultant. The Consultant's decision shall be final and shall not require explanation. There shall be no increase in the contract Price due to the Consultant's rejection of a proposed equivalent product.
- .6 Only base specified products, specified acceptable products or equipment listed as alternate will be considered for acceptance by the PUC. No proposed substitutions will be accepted.
- .7 Indicate on Document "Form of Supplementary Mechanical Tender," the names of the manufacturers for materials and equipment that you will supply, and which were specified or scheduled with a manufacturer's name. Note: The names of manufacturers on the list must be one (1) of the names stated as acceptable for the particular products, unless prior written permission has been given for use of products by alternative manufacturers. Submit as directed in the "Form of Supplementary Mechanical Tender" and unless otherwise specified, submit a copy of this form with the Bid.

### 1.18 IMPERIAL AND METRIC MEASUREMENTS

- .1 Generally, both imperial and metric units of measurement are given in Sections of the Specification governed by this Section. Metric conversions are "Soft" and have been rounded off.

## **SECTION 15010 – MECHANICAL WORK GENERAL INSTRUCTIONS**

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### **1.19 BREAKDOWN OF MECHANICAL WORK COST**

- .1 Submit to the Consultant a typewritten breakdown of the mechanical work cost with a schedule of values of the various parts of the work, aggregating the total cost of the mechanical work.
- .2 The extent of the breakdown shall be as directed by the Consultant. The breakdown must be acceptable to the Consultant and is required to assist in evaluation of monthly progress draws.
- .3 Submit the breakdown within 10 days of written notification of acceptance of Bid and award of contract.

### **1.20 SUB-CONTRACTORS TO THE MECHANICAL CONTRACTOR**

- .1 The Mechanical Contractor agrees to employ those sub-contractors proposed in the Mechanical Form(s) of Tender and accepted by the Owner at the signing of the Contract with the General Contractor.
  - .1 The Owner may, for reasonable cause object to the use of a proposed Sub-Contractor and consequently, may require the Mechanical Contractor to employ one of the other Sub-Contractors or Bidders.
- .2 In the event that the Owner requires a change from a proposed Sub-Contractor originally proposed by the Mechanical Contractor, the Contract Price shall be adjusted by the difference in cost.
- .3 The Mechanical Contractor shall not be required to employ as a Sub-Contractor, a firm to whom he may reasonably object.

### **1.21 ENERGY EFFICIENCY OF PRODUCTS**

- .1 Unless otherwise specified, material and equipment supplied shall meet or exceed minimum efficiencies and/or minimum performances of ASHRAE Standard ASHRAE/IES 90.2013.

### **PART 2 - PRODUCTS**

**NIL**

### **PART 3 - EXECUTION**

**NIL**

**END OF SECTION 15010**

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## **SECTION 15050 – MECHANICAL BASIC MATERIALS AND METHODS**

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## **SECTION 15050 – MECHANICAL BASIC MATERIALS AND METHODS**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 Section 15010 in this Division of the Specification applies to and is part of this Section of the Specification.

#### **1.2 APPLICATION**

- .1 This Section specifies products, common criteria and characteristics, and methods and execution that are common to one (1) or more Sections of Division 15. It is intended as a supplement to succeeding Sections of Division 15 and shall be read accordingly.

#### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings for all products specified in Part 2.

#### **1.4 SUBMITTALS**

- .1 Submit the following to the Consultant for review:
  - .1 a sample of each proposed type of access door, as well as a Sepia print of architectural reflected ceiling plan drawings showing proposed ceiling access door locations;
  - .2 location drawings for all required sleeves and formed openings in poured concrete or precast concrete construction;
  - .3 samples of materials and any other items as specified in succeeding Sections of this Division of the Specification.
- .2 Submit an affidavit stating that lead free solder was used for all soldered joints in copper potable water, drainage and vent piping.

#### **1.5 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 The following work which is related to the work of Division 15 is specified in other Sections of other Divisions of the Specification:
  - .1 installation of access doors in building finishes;
  - .2 provision of large access doors and panels in building finishes;
  - .3 power wiring connections to motor control centres;
  - .4 provision of 115 volt control and interlock wiring, unless otherwise noted;
  - .5 finish painting of exposed mechanical work;
  - .6 flashing for mechanical work penetrating the roof.

#### **1.6 REFERENCE CODES AND STANDARDS**

- .1 Codes and/or Standards published by various Societies and Associations listed below, may be referenced throughout this Section and other Sections of Division 15:
  - .1 Associated Air Balance Council (AABC);
  - .2 Air Movement and Control Association (AMCA);
  - .3 American National Standards Institute (ANSI);
  - .4 Air - Conditioning and Refrigeration Institute (ARI);
  - .5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE);
  - .6 The American Society of Mechanical Engineers (ASME);

## SECTION 15050 – MECHANICAL BASIC MATERIALS AND METHODS

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- .7 American Society of Testing and Materials (ASTM);
- .8 American Water Works Association (AWWA);
- .9 National Standards of Canada (CAN);
- .10 Canadian Gas Association (CGA);
- .11 Canadian General Standards Board (CGSB);
- .12 Canadian Standards Association (CSA);
- .13 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
- .14 Factory Mutual Systems (FM);
- .15 Institute of Electrical and Electronic Engineers (IEEE);
- .16 International Standards Organization (ISO);
- .17 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);
- .18 National Environmental Balancing Bureau (NEBB);
- .19 National Fire Protection Association (NFPA);
- .20 Occupational Safety & Health Administration (OSHA);
- .21 Ontario Building Code (OBC);
- .22 Thermal Insulation Association of Canada (TIAC);
- .23 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA);
- .24 Underwriters Laboratories of Canada Inc. (ULC).

### PART 2 - PRODUCTS

#### 2.1 PIPE SLEEVES

- .1 Minimum No. 24 USS gauge (0.635 mm thick) galvanized steel with an integral flange to secure the sleeve to formwork construction.
- .2 Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.
- .3 Schedule 40 mild galvanized steel pipe.

#### 2.2 FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Systems shall consist of asbestos-free, both elastomeric materials and intumescent materials, tested, listed and labelled by ULC in accordance with CAN 4-S115-M85, and CAN/ULC-S101-M for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) not less than the fire rating for surrounding construction. The fire stopping and smoke seal material system must be specifically ULC certified with designated reference number for its specific installation. Submit copy of ULC certificate, drawings and number for each installation.
- .2 Materials shall be compatible with abutting dissimilar materials and finishes. Coordinate material requirements with trades supplying abutting areas of materials.
- .3 Acceptable certification shall also include certification by Underwriters Laboratories of Northbrook IL, using test conforming to ULC-S115 and given cUL listing published by UL in their "Products Certified for Canada (cUL) Directory."

## SECTION 15050 – MECHANICAL BASIC MATERIALS AND METHODS

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- .4 Include costs for and arrange for manufacturer's authorized representative to inspect and verify each installation and application. Submit test report signed and verified by Contractor and manufacturer's representative.
- .5 Pipe insulation forming part of a ULC fire and smoke seal assembly is specified in Section 15250.
- .6 Acceptable manufacturers are 3M Canada Inc., Tremco, Specified Technologies Inc. and A/D Fire Protection Systems and Hilti Canada.

### 2.3 PIPE ESCUTCHEON PLATES

- .1 One-piece chrome plated black steel or stainless steel plates, sized to cover pipe sleeves or wall or slab openings and to fit tightly around the pipe or pipe insulation.

### 2.4 CAST IRON PIPE, FITTINGS AND JOINTS

- .1 Class 4000 cast iron pipe and fittings certified to CAN/CSA-B70-M91.
- .2 Centrifugally cast ductile iron to ANSI/AWWA C151/A21.51-91 complete with a cement mortar lining to ANSI/AWWA C104/A21.4-90 and a protective coating of bituminous paint, standard cement lined cast iron mechanical joint fittings to ANSI/AWWA C110/A21.10-1987 painted as for pipe, and rubber gasket joints to ANSI/AWWA C111/A21.11-90 with electric conductivity strips to bridge joints.

### 2.5 COPPER PIPE FITTINGS AND JOINTS

- .1 Type "K"/"L"/"M", hard drawn seamless copper, certified to ASTM B88-88 "Seamless Copper Water Tube", with forged copper solder type fittings to ANSI B16.22-1989, and soldered joints, using 95/5 Tin/Antimony solder.
- .2 Type "L", hard drawn seamless copper tubing to ASTM B280-88, factory cleaned in accordance with ASTM B280-88 and ANSI B9.1-1971, pressurized with nitrogen and supplied with capped ends, and complete with factory washed and capped wrought copper soldering fittings, and solder joints made with high melting point silver brazing alloy conforming to AWS Classification BCuP-5.
- .3 Type "L", seamless soft copper to ASTM B77, in continuous lengths of proper size with no joints wherever possible, but with flared tube fitting type joints where absolutely essential.

### 2.6 GROOVED END COPPER PIPE, FITTINGS AND JOINTS

- .1 Victaulic Co. of Canada Ltd. "No-Sweat" couplings and fittings as specified hereinafter.
- .2 Style "606" couplings to CSA B242-M1980, consisting of ductile iron housings to ASTM A-536 (Grade 65-45-12) with coating of copper alkyd enamel paint, pressure responsive moulded synthetic rubber gaskets to ASTM D-2000 selected by the manufacturer for the intended service, and zinc plated carbon steel nuts, bolts and washers to ASTM A-183 with minimum 110,000 psi (758,400 kPa) tensile strength.
- .3 Style "641" flange adapters with ANSI Class 125 or 150 bolt hole pattern, as applicable, consisting of ductile iron housings to ASTM A-536 (Grade 65-45-12) with coating of copper alkyd enamel paint, electroplated steel hinge bushing, pressure responsive moulded synthetic rubber gaskets to ASTM D-2000 selected by the manufacturer for the intended service, and zinc plated carbon steel nuts, bolts and washers to ASTM A-183 with minimum 110,000 psi (758,400 kPa) tensile strength. Where required, flange adaptors shall be supplied with a phenolic (Type F) flange washer between flange and mating surface.
- .4 Full flow, factory grooved end copper fittings to ASTM B-75 C12200 for piping sized 4" (100 mm) diameter and smaller. Fittings for piping sized larger than 4" (100 mm) diameter, shall be full flow, grooved end, cast bronze to ASTM B-584-87 CDA 844(81-3-7-9).
- .5 DWV grade hard temper copper to ASTM B306-88 "Copper Driantage Water Tube (DWV)", with rolled grooved ends to manufacturer's latest published specifications.
- .6 Type "L" hard drawn seamless copper, certified to ASTM B88-88 "Seamless Copper Water Tube" with rolled grooved ends to manufacturer's latest published specifications.

**2.7 PROPRESS COPPER PIPE, FITTINGS AND JOINTS**

- .1 Viega “ProPress” couplings and fittings as specified hereinafter.
- .2 Copper tubing shall conform to ASTM B 75 or ASTM B88.
- .3 Copper fittings shall conform to ASME B16.18, ASME B16.22 or ASME B16.26.
- .4 Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press ends shall have SC (Smart Connect™) feature design w/Smart Connect(leakage path). In ProPress ½” to 4” dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.
- .5 Pipe Threads shall conform to ASME B1.20.1.E.
- .6 Hangers and supports shall conform to MSS-SP-58.

**2.8 BLACK STEEL PIPE, FITTINGS AND JOINTS**

- .1 Mild black carbon steel, Grade A, ASTM A53, continuous weld fabricated for pipe with screwed joints, ASTM A53 electric resistance weld fabricated, mill or site bevelled for pipe with welded joints.
- .2 Pipe for fire protection work shall be mild black carbon steel, Grade A ASTM A-795, continuous weld fabricated for pipe with screwed joints, ASTM A-795 electric resistance weld fabricated, mill or site bevelled for pipe with welded joints.
- .3 Threaded fittings shall be Class 125 (standard) or Class 250 (extra heavy) cast iron threaded fittings to ANSI/ASME B16.4.
- .4 Welding fittings shall be factory made, seamless carbon steel, bevelled, butt welding fittings to ASTM A234, Grade WPB, with a wall thickness to match the pipe wall thickness. All elbows shall be long radius pattern except where space conditions do not permit.

**2.9 PLASTIC PIPE, FITTINGS AND JOINTS**

- .1 IPEX Inc., "BDS", or equal rigid PVC sewer pipe and fittings with solvent weld joints to CSA B182.1.
- .2 IPEX Inc., "Ultra- Rib", or equal rigid PVC sewer pipe and fittings with gasketed joints, Certified to CAN/CSA-B182.4-92 and to ASTM F794. Joints shall withstand 345 kPa hydrostatic pressure.
- .3 IPEX Inc., "BLUE BRUTE" Class 150 "Ring-Tite" rigid PVC pipe, and fittings certified to CAN/CSA-B137.2-M90 and CAN/CSA-B137.2-M89 respectively and FM approved.

**2.10 PIPING UNIONS**

- .1 Dart Union Co. of Canada Ltd., or equal malleable iron, ground joint, brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).
- .2 Malleable iron, ground joint, factory tested “RAILROAD” type screwed unions and union elbows with a brass to iron seat and a minimum pressure rating of 4140 kPa (600 psi) WOG (non-shock).

**2.11 DIELECTRIC PIPE FITTINGS**

- .1 Victaulic Co. of Canada Ltd., style 47 “Clearflow” dielectric pipe fittings to ASTM F-492-77, suitable for maximum temperatures of 107°C (225°F) and pressures of 2070 kPa (300 psi), and each complete with electro-zinc plated casing, NSF/FDA listed, chemically inert dielectric thermoplastic lining, ends to suit piping and overall fitting length matched to pipe size for maximum galvanic corrosion protection.
  - .1 acceptable manufacturers are Victaulic Co. of Canada Ltd. and Gruvlok Corporation.

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- .2 Watts Regulator of Canada Ltd. Series 3000 dielectric pipe unions suitable for use with steam to 149°C (300°F) at 345 kPa (50 psi), to ANSI B16.39 and threaded to ANSI B2.1.

### 2.12 PIPING DRAIN VALVES

- .1 Minimum 2070 kPa (300 psi) water rated, 19 mm (3/4") diameter straight pattern bronze globe valve or a bronze ball valve, each complete with a threaded outlet suitable for coupling connection of 19 mm (3/4") diameter garden hose, and a cap and chain.
- .2 Acceptable manufacturers are Jenkins Valves, Crane Canada Inc., KITZ, Newman-Hattersley, Apollo, Toyo and Nibco.

### 2.13 PIPING AIR VENTS

- .1 Flair Hydronics (Johnson Paterson), No. 16 or equal, 3.2 mm (1/8") diameter manual valve with a wooden handle.
- .2 Spirax Sarco Canada Ltd., float actuated air vents, type 13 WS for systems with a working pressure to 1035 kPa (150 psi), type 13 WHS for systems with a working pressure greater than 1035 kPa (150 psi), each complete with a cast iron body and cap, a stainless steel float assembly and seat, and a neoprene head.
- .3 Acceptable manufacturers are Spirax Sarco Canada Ltd., ITT Bell & Gossett, Armstrong, and Braukmann.

### 2.14 GATE, GLOBE AND SWING TYPE CHECK VALVES

- .1 Valves scheduled hereinafter are Jenkins Valves.
- .2 All valves shall be, to the extent possible, the product of a single manufacturer and shall have the manufacturer's name, pressure rating and size clearly marked on the body.
- .3 Valves 50 mm (2") and smaller shall be constructed of bronze. Valves 65 mm (2-1/2") and larger shall have iron bodies and bronze mountings.
- .4 The bronze in bodies and bonnets of all bronze valves shall conform to ASTM B-62 for valves rated up to 1035 kPa (150 psi) steam pressure, and ASTM B61 for valves rated at 1380 kPa (200 psi) and 2070 kPa (300 psi) steam pressure.
- .5 Bodies and bonnets of iron body valves shall conform to ASTM A-126, Class B.
- .6 Generally, valves 75 mm (3") and smaller shall be complete with screwed ends, except for bronze valves installed in copper piping which shall be complete with soldering ends. Generally, valves larger than 75 mm (3") shall be complete with flanged ends and proper flanged adapters to copper shall be provided where flanged valves are installed in copper piping.
- .7 Valves for installation in chilled water, condenser water, domestic water, heating system water and glycol solution piping with pressures less than 1035 kPa (150 psi), unless otherwise noted, shall conform to the following schedule:

| VALVE TYPE   | PRESSURE RATING WOG |           | ENDS      | JENKINS FIG. NO. |
|--------------|---------------------|-----------|-----------|------------------|
| BRONZE GATE  | 2070 kPa            | (300 psi) | SOLDERING | 813              |
| BRONZE GATE  | 1380 kPa            | (200 psi) | SCREWED   | 810              |
| BRONZE GLOBE | 2070 kPa            | (300 psi) | SCREWED   | 106-B            |
| BRONZE GLOBE | 2760 kPa            | (400 psi) | SCREWED   | 2050             |
| BRONZE CHECK | 2760 kPa            | (250 psi) | SCREWED   | 4092             |
| BRONZE CHECK | 2070 kPa            | (300 psi) | SOLDERING | 4093             |
| IRON GATE    | 1380 kPa            | (200 psi) | FLANGED   | 454              |
| IRON CHECK   | 1380 kPa            | (200 psi) | FLANGED   | 587              |

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- .8 Valves for installation in low or medium pressure steam and condensate piping less than 100 psi (690 kPa) shall be complete with proper discs for steam service and shall conform to the following schedule:

| VALVE TYPE   | PRESSURE RATING WOG |           | ENDS    | JENKINS FIG. NO. |
|--------------|---------------------|-----------|---------|------------------|
| BRONZE GLOBE | 2070 kPa            | (300 psi) | SCREWED | 2032J            |
| BRONZE GATE  | 1380 kPa            | (200 psi) | SCREWED | 810J             |
| BRONZE CHECK | 1725 kPa            | (250 psi) | SCREWED | 4092J            |
| BRONZE GLOBE | 2760 kPa            | (400 psi) | SCREWED | 2050J            |
| IRON GLOBE   | 1380 kPa            | (200 psi) | FLANGED | 2342J            |
| IRON GATE    | 1380 kPa            | (200 psi) | SCREWED | 453J             |
| IRON GATE    | 1380 kPa            | (200 psi) | FLANGED | 454J             |
| IRON CHECK   | 1380 kPa            | (200 psi) | SCREWED | 588J             |
| IRON CHECK   | 1380 kPa            | (200 psi) | FLANGED | 587J             |

- .9 Wheels on bronze gate and globe valves, unless otherwise noted, shall be non-heating malleable iron finished in baked enamel. Wheels on iron body valves shall be cast iron wheels suitable for easy valve operation.
- .10 Acceptable manufacturers are Crane Canada Inc., KITZ, Milwaukee Valve Company, Newman-Hattersley Ltd., Bonney Forge, Toyo, RP&C (Conbraco Industries) and Nibco.

**2.15 BALL VALVES**

- .1 Unless otherwise noted, full bore, solid ball, bronze ball valves as follows:
- .1 for copper water piping, Jenkins Valves Fig. No. 202J 4140 kPa (600 psi) W.O.G. with PTFE seats and soldering ends;
  - .2 for steel heating water piping, Kitz Valves Fig. No. 201J, 4140 kPa (600 psi) W.O.G. rated with PTFE seats and seals, and screwed ends;
  - .3 for steel glycol solution heating piping, Jenkins Valves Fig. No. 58J, 4140 kPa (600 psi) W.O.G. rated with PTFE seats, packing and “D” ring, adjustable packing box and screwed ends.
  - .4 For natural gas and LP gas piping, with maximum 3.45 kPag (1/2 psig) pressure Neo Valves No. 460 CGA approved, with PTEF seats and screwed ends.
  - .5 For natural gas and LP gas piping, with maximum 862 kPag (125 psig) pressure, Neo Valves No. 525 CGA approved, full bore with chrome plated body, PTFE seats, screwed ends and suitable for -40° to 65°C (-40°to 150°F) Temperature range.
- .2 Ball valves in insulated piping shall be complete with extended handles to clear insulation.
- .3 Acceptable manufacturers for valves used in services other than natural gas are Jenkins Valves, Crane Canada Inc., Nibco Inc., Kitz, Milwaukee Valve Company, Newman-Hattersley, Toyo, Apollo, Victaulic Co. of Canada Ltd. and Watts Regulator of Canada Ltd.
- .4 Acceptable manufacturers of valves used in natural gas service are Neo Metals, KITZ, Toyo and Newman-Hattersley.

**2.16 BUTTERFLY VALVES**

- .1 DeZurik of Canada Ltd., Fig. No. BGS-L1, lug body type, 1200 kPa (175 psi) rated, resilient seated butterfly valves, each complete with a stainless steel shaft, corrosion resistant disc, a seat suitable in all respects for the application, and a flange arrangement which maintains tight shut-off and the valve in position when one side of the connecting piping is removed.

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- .2 Butterfly valves up to and including 150 mm (6") diameter shall be equipped with "ON/OFF" lever handles. Butterfly valves 200 mm (8") and larger shall be equipped with wheels and gear operators.
- .3 Acceptable manufacturers are DeZurik of Canada Ltd., Keystone Ltd., Watts Industries, Jenkins Valves, Crane Canada Inc., Newman-Hattersley, Centerline, Apollo, Mueller, KITZ, Toyo, WKM and Demco

### 2.17 WAFER TYPE CHECK VALVES

- .1 Gulf Valve Co., "WAFER CHECK", threaded lug type, ANSI Series 150, 1965 kPa (285 psi) rated at 38°C (100°F), non-slam wafer check valves, each complete with a carbon steel body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must be equal the inside diameter of the connecting pipe.
- .2 Acceptable manufacturers are Gulf Valve Co., Checkrite, Mission (Duo-Chek II), Moygro and Victaulic Co. of Canada Ltd. (No. 715 dual disc).

### 2.18 LUBRICATED PLUG VALVES

- .1 Neo Metals Ltd., No. AR40034 screwed and or No. AR40114 flanged or equal CGA approved, cast iron, 1035 kPa (150 psi) rated lubricated plug valves, each complete with a lubricant screw, a lubricant valve, lubricant receptacle, a loose operator, and a plug with lubricant grooves circling the passage in both the open and closed position to ensure a positive seal.
- .2 Acceptable manufacturers are Neo Metals and Newman Hattersley.

### 2.19 VALVE IDENTIFICATION TAGS

- .1 Embree Marking Systems or W.H. Brady Co., non-ferrous metal valve tags with a stamped consecutive number filled in with black paint, and a heavy-gauge non-ferrous metal chain, ring, or "S" hook for attaching the tag to a valve stem or handle.

### 2.20 PIPING STRAINERS

- .1 Spirax Sarco Ltd., cast iron wye shaped strainers, type IF-125 screwed and/or type AF-250 flanged, each suitable for working pressures to 890 kPa (130 psi), and complete with a removable type 304 stainless steel strainer screen with perforations sized to suit the application.
- .2 Spirax Sarco Ltd., Type IT, screwed and/or type AF-250 flanged cast iron strainers, generally as specified above but suitable for working pressures in excess of 890 kPa (130 psi).
- .3 Strainers 50 mm (2") diameter and larger shall be complete with blowdown pipe connection tappings.
- .4 Acceptable manufacturers are Spirax Sarco Ltd., Crane Canada Inc., Nibco Inc., Kitz, Milwaukee Valve Company, Newman-Hattersley, Mueller Steam and Watts Industries.

### 2.21 PIPING HANGERS AND SUPPORTS

- .1 For horizontal piping above ground - adjustable wrought steel clevis hangers and/or adjustable malleable iron swivel ring hangers and/or steel offset pipe hooks and/or heavy steel pipe clips as required.
- .2 For 50 mm (2") diameter and larger horizontal piping above ground conveying a medium with an operating temperature 37.7°C (100°F) and greater - adjustable roller hangers.
- .3 For vertical piping - wrought steel riser clamps and/or heavy steel pipe clips and/or 12 mm (1/2") thick welded black structural steel plate anchor assemblies.
- .4 Spring hangers for portions of piping connected to motorized and/or vibration isolated equipment - spring hangers as specified in this Section in the article entitled "VIBRATION ISOLATION MATERIALS."

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- .5 For groups of pipe having the same slope - black structural steel angle wall brackets and/or black steel channels or angles of proper dimension supported by hanger rods, and/or Unistrut Ltd. or equal support assemblies.
- .6 Hanger rods shall be black steel, round, threaded, to ASTM A36, sized to suit the loading but in any case minimum 9.5 mm (3/8") diameter, complete with captive machine nuts with washers at hangers.
- .7 Acceptable hanger and support manufacturers are Anvil, Myatt, Hunt Manufacturing and Apex.

### 2.22 ACCESS DOORS

- .1 Acudor Acorn Limited, minimum No. 14 USS gauge (2.0 mm thick) prime coat painted steel flush access doors, each complete with a heavy frame and anchor, heavy-duty rust-resistant concealed hinges, a positive locking screwdriver lock, and mounting and finishing features to suit the particular construction in which it is to be installed.
- .2 Access door sizes shall suit the concealed work for which they are supplied, and have the minimum dimensions of 450 mm x 450 mm (18" x 18") at ceiling and 300 mm x 300 mm (12" x 12") at wall.
- .3 Access doors in fire rated construction shall be ULC listed and labelled and of a rating to maintain the fire separation integrity.
- .4 Where access doors are located in surfaces where special finishes are required, they shall be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout.
- .5 Acceptable manufacturers are Acudor Acorn Limited and The Williams Brothers Corporation.

### 2.23 PRESSURE GAUGES AND THERMOMETERS

- .1 H.O. Trerice Co., pressure gauges, thermometers and accessories as follows:
  - .1 pressure gauges - No. 600 Series to ANSI Standard B40, Grade A, fully adjustable, 115 mm (4-1/2") diameter, complete with a cast aluminum casing, clear glass window, white dual scale (psi and kPa) dial, red tipped black pointer, bronze bushed movement, pressure snubber, and "T" handle gauge cock;
  - .2 thermometers - No. BX93403-1/2 to CAN/CGSB Standard 14.4-M88 fully adjustable angle, 225 mm (9") white dual scale (°F and °C), complete with cast aluminum case, clear acrylic window lens, front red reading mercury tubing, separable brass socket, brass piping well, and extension necks where used in insulated pipe or equipment.
- .2 Thermometers in ductwork shall be equipped with Trerice No. 065-0015 or equal mounting flanges.
- .3 Pressure gauge and thermometer scale ranges shall be such that the working temperature or pressure of the system for which the instrument is provided is at approximately the mid-point of the instrument scale.
- .4 Pressure gauges in sprinkler fire protection piping shall be Winters, Model Q1721 or equal ULC listed pressure gauges.
- .5 Instruments and associated accessories shall be registered with the Technical Standards and Safety Authority (TSSA) and shall be complete with CRN No. where possible the CRN No. shall be permanently fixed to the component.
- .6 Acceptable manufacturers of pressure gauges (other than fire protection) and thermometers and related accessories are H.O. Trerice Co. Ltd., Winters, Ashcroft (Dresser Canada Inc.) and Weksler.

### 2.24 EQUIPMENT DRIVE GUARDS AND ACCESSORIES

- .1 Guards for V-belt drives shall be removable four (4) sided, fully enclosed galvanized sheet steel guards to OSHA Standards, complete with 112 mm (4-1/2") diameter tachometer openings covered with removable perforated galvanized plates at each shaft location.



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- .2 Guards for flexible couplings shall be removable “U” shaped galvanized steel guards with a 2.3 mm (0.0905”) thick frame and expanded mesh face.
- .3 Guards for exposed fan blades, unless otherwise noted, shall be removable 19 mm (3/4”) galvanized steel wire mesh with galvanized steel frames.

### 2.25 ELECTRIC MOTORS

- .1 Motors shall conform to EEMAC Standard MG1, applicable IEEE Standards, and applicable CSA Standards unless otherwise noted.
- .2 All motors located outside the building, and inside the building in areas exposed to the weather or in sprinklered areas shall be totally enclosed fan cooled type unless otherwise noted, each with a service factor of 1.15 at 40°C (104°F) ambient temperature for all ratings.
- .3 All other motors shall be open drip-proof type unless otherwise noted.
- .4 Vertically mounted and submersible motors shall be purposely designed for mounting in this attitude.
- .5 Unless otherwise noted, motors less than 0.4 kW (1/2 HP) size shall be single phase, 115 volt, 60 cycle, A.C. condenser type.
- .6 Unless otherwise noted, motors 0.4 kW (1/2 HP) size and larger shall be 3 phase, 60 cycle, 1750 RPM, EEMAC design “A,” “B” or “C” for normal or high starting torque as required by the application.
- .7 Motors .746 kW (1 HP) and larger shall be T-Frame, A.C., 3 phase heavy duty service and equal to or exceeding the Energy Policy Act of 1993 and Table 10.2 of ASHRAE 90.1-1999 as tested to either CSA 390 M 1985, or IEEE 112B, and be approved under the Canadian Electrical Safety Code.
- .8 Each motor shall be suitable for direct coupling or V-belt drive as required.
- .9 The frame of each 3-phase motor shall be constructed of corrosion-resistant cast iron with integrally cast feet except for smaller drip-proof motors which may have a rolled steel frame and welded feet. End brackets shall also be constructed of cast iron with precision machined bearing fits. The stator core assembly of each motor shall consist of stacked laminations of specially selected electrical grade steel. Insulation materials shall be non-hygroscopic and meet or exceed Class “B” definition. Motor temperature ratings shall not exceed Class “B” temperature limits when the motor is operated at full load in a maximum ambient temperature of 40°C (104°F).
- .10 Motors used with pulse width modulating variable speed drives shall be inverter duty motors with Class “H” windings and Class “F” insulation.
- .11 Rotor windings shall be die-cast aluminum, surface treated for minimum rotor losses. Each shaft shall be dynamically balanced.
- .12 Bearings, unless otherwise noted, shall be grease lubricated with readily accessible plugs or fittings to allow “in-service” regreasing. Bearings shall be ball type, double shielded, single row width, made from vacuum degassed steel, except for large belted frames where roller bearings are required.
- .13 Explosion proof motors shall be flame proof type with an explosion proof box and in accordance with CSA C22.2 No. 145-M1986 and Code requirements.
- .14 Motors 22.4 kW (30 HP) and larger shall be complete with or approved equal manual reset resistor type sensing elements with positive temperature co-efficients and tripping relays to disengage the motor starter when an abnormal temperature is sensed within the motor. Turn over the starter tripping relays to the electrical trade for integration into the respective motor starter.
- .15 Motors 112 kW 150 HP) and larger controlled by reduced voltage, wye-delta” starters shall be complete with six (6) leads for connection to the respective motor starter.
- .16 Refer to starter schedule drawing(s) for motor voltage and phase requirements.
- .17 Acceptable manufacturers for motors 0.75 kW (1 HP) and larger are US Motors, TECO (Westinghouse Canada Inc.), WEG (V.J. Pamensky), Lincoln Electric Co. Ltd., and Toshiba International Corp.

- .18 Acceptable manufacturers for motors less than 0.75 kW (1 HP) are Canadian General Electric Co. Ltd., Emerson Electric Canada Ltd., Baldor Electric Co. and LEESON Electric (Canada) Ltd.

**2.26 MOTOR STARTERS AND ACCESSORIES**

- .1 Allen-Bradley Canada Ltd., NEMA type, motor starters in accordance with the following specification and the motor starter schedule(s), unless otherwise noted.
- .2 Unless otherwise noted, starters for single phase motors shall be Bulletin 600, 115 volt, thermal overload protected manual starting switches with a neon pilot light, a surface or flush mounting EEMAC enclosure to suit the application, and, where automatic operation is required, a separate "hand-off-automatic" selector switch in an enclosure to match the starter enclosure. Field design and assembled starters will not be accepted.
- .3 Unless otherwise noted, starters for 3-phase motors less than 37.3 kW (50 Hp), shall be combination "quick-make" and "quick-break" fused disconnects and full voltage, non-reversing magnetic starters for across-the-line service. Full protection of each phase shall be included in the starters by means of one (1) overload relay per phase per starter. Starters shall be equipped with "hand-off-automatic" switches, pilot lights, control transformers, external overload reset push button, two (2) NO and NC, and other accessories as per the starter schedule(s). Field design and assembled starters will not be accepted.
- .4 Unless otherwise noted, starters for 3-phase motors 37.3 kW (50 HP) up to 112 kW (150 HP), shall be reduced voltage, non-reversing, autotransformer type starters. Full protection of each phase shall be included in the starters by means of one (1) overload relay per phase per starter. Starters shall be equipped with "hand-off-automatic" switches, pilot lights, control transformers, external overload reset push button, two (2) NO and NC contacts, and other accessories as per the starter schedule(s). Field design and assembled starters will not be accepted.
- .5 Unless otherwise noted, starters for 3-phase motors 112 kW (150 HP) or larger, shall be reduced voltage, non-reversing, closed transition "wye-delta" starters. Full protection of each phase shall be included in the starters by means of one (1) overload relay per phase per starter. Starters shall be equipped with "hand-off-automatic" switches, pilot lights, control transformers, external overload reset push button, two (2) NO and NC contacts, and other accessories as per the starter schedule(s). Field design and assembled starters will not be accepted.
- .6 Enclosures for starters located in sprinklered areas shall be EEMAC 2. All other loose starter enclosures shall be EEMAC 1 unless otherwise noted.
- .7 Motor control centres shall be Allen-Bradley of Canada Ltd. Bulletin 2100 "CENTRELINE," 2.28 m (7-1/2') high, multi-unit control centres, arranged as per the starter schedule. Each control centre shall be an EEMAC Class 1, type "B" factory assembled, dead front, floor mounted control centre with tin plated copper bus and an EEMAC type 1 or 2 enclosure as for loose starters specified above. Starters installed in control centres shall be as specified above and complete with load wiring and/or control wiring terminal boards. Motor control centres shall be complete with all required provisions for electric "line" and "load" side power connections. All motor control centres shall be complete with at least space for two (2) future starters.
- .8 Disconnects for motor control centres shall be heavy-duty, CSA approved, front operated with a handle suitable for padlocking in the "OFF" position and arranged so that the enclosure cover cannot be opened while the handle is in the "ON" position. Fusible units shall be complete with fuse clips for HRC fuses, unless otherwise noted. Enclosures shall be EEMAC type 1 or 2 as specified for loose starters above. The ampere rating, number of poles, and fuse requirements shall be as indicated on the starter schedule(s).
- .9 Unless otherwise indicated, fuses shall be Form I, Class "J," HRC fuses for constant running equipment and Form II, Class "C," HRC fuses for motorized equipment that cycles "ON" and "OFF."
- .10 Identification nameplates shall be engraved black-white-black Lamacoid, suitably sized, complete with bevelled edges and stainless steel securing screws. Engraving must be approved by the Consultant.
- .11 Each starter you supply must be capable of starting the particular motor under the imposed load.

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- .12 Acceptable motor starter manufacturers are Allen-Bradley Canada Ltd., Square D (by Schneider Electric), Cutler-Hammer Canada Ltd., Moeller Ltd. and Siemens. All units must be CSA/ULC approved.
- .13 Acceptable fuse manufacturers are Bussman, Ferraz Shawmut, Noram and English Electric.

### 2.27 VIBRATION ISOLATION MATERIALS

- .1 BVA Systems Ltd., vibration isolation materials as per the drawing schedule and as specified below.
- .2 All springs shall be stable, colour coded, selected to operate at no greater than 2/3 solid load, and with spring diameters in accordance with the manufacturer's recommendations to suit the static deflection and maximum equipment load.
- .3 Spring mounts shall be complete with levelling devices, 6 mm (1/4") thick, ribbed neoprene sound pads and zinc plated hardware.
- .4 Type "SH" spring hangers shall be complete with a painted steel housing, an acoustic washer or elastomeric element, a steel washer, retaining cups and selected springs. All hangers must be capable of tolerating a vertical misalignment of 15° (from hangers axis) without loss of stability.
- .5 Type "FS" free standing spring mounts with extra stable iso-stiff springs.
- .6 Type "NSN" neoprene-steel-neoprene pads shall consist of two (2) layers of 12 mm (1/2") thick type "N" waffle pads bonded to each side of a 1.6 mm (1/16") thick steel plate. All holes shall be sleeved and complete with isolation washers.
- .7 Spring mounts for equipment located outside the building shall be factory weather-proofed by means of two (2) coats of rust resisting paint, two (2) coats of neoprene and complete with neoprene pads in lieu of standard rubber pads.
- .8 Acceptable manufacturers are BVA Systems Ltd., Vibron, Masdom Corp., and J.P. Environmental Products Inc.

### 2.28 IDENTIFICATION NAMEPLATES

- .1 Laminated plastic (lamacoid) black-white-black with bevelled edges, stainless steel screws, and proper identification engraving. Each nameplate shall be sized to suit the equipment for which it is provided, and the required wording.
- .2 Minimum size is 1" high x 2" long.

### 2.29 GROOVED END BLACK STEEL PIPE, FITTINGS AND JOINTS

- .1 Mild black steel pipe to ASTM A-120 or A53-90, with factory or site grooved ends square cut or rolled in accordance with Victaulic Co. of Canada Ltd. Specification TS215/83 and to requirements of CSA B242-M1980.
- .2 Couplings shall be Victaulic Co. of Canada Ltd., ULC and FM approved grooved end pipe couplings to CSA B242-M1980, consisting of housings, gaskets, nuts and bolts. Housings shall be cast malleable (ASTM A-47) or ductile (ASTM A-536) iron cast in two (2) or more parts and secured together by heat treated carbon steel bolts and nuts conforming to ASTM A183. Gaskets shall be mechanical grooved coupling design pressure responsive elastomer gaskets, colour code green, suitable in all respects for the application.
- .3 Couplings for piping risers, mains and in Equipment Rooms shall be Style 07 "ZERO-FLEX" type.
- .4 Couplings for standpipe or sprinkler system piping with pressure less than 175 psi (1200 kPa) shall be style 05 "FIRELOK", other couplings shall be style 07 "ZERO-FLEX".
- .5 Fittings shall be malleable or ductile iron grooved end design fittings to accept grooved mechanical couplings without field preparation. Unless otherwise noted in succeeding Sections of this Division, Victaulic "FIT" tee, elbow and similar fittings shall not be used.

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- .6 Acceptable manufacturers are Victaulic Co. of Canada Ltd. and Grinnell Corp. Refer to Motor Starter Schedule SS-01 and delete item #4 from this schedule.

### 2.30 MECHANICALLY BONDED BLACK STEEL PIPE, FITTINGS AND JOINTS

- .1 Victaulic Co. of Canada Ltd., "PRESSFIT" couplings and fittings consisting of formed, precision cold drawn steel assemblies complete with O-ring seals selected by the manufacturer for the intended system service, rated to 300 psi (2070 kPa) pressure and to 230 degrees F. (110 degrees C.) temperature and ULC listed and labelled and FM approved for fire protection service to 175 psi (1205 kPa) pressure.
- .2 Pipe shall be approved Schedule 5 to ASTM A-135, A-795 or A53-90 mild black steel, unless otherwise noted, supplied by the fitting manufacturer.

## PART 3 - EXECUTION

### 3.1 GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

- .1 Unless otherwise noted, locate and arrange horizontal pipes and ducts above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained.
- .2 Unless otherwise noted, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas.
- .3 Install all pipes and ducts parallel to building lines.
- .4 Neatly group and arrange all exposed work.
- .5 Do not make pipe joints in wall or slabs.
- .6 Locate all valves, dampers and any other equipment which will or may need maintenance or repairs and which are installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical piping in shafts, pipe spaces or partitions, locate the accessories at the floor level.
- .7 Make all connections between pipes of different materials using proper approved adapters. Provide cast brass dielectric type adapters at connections between steel and copper pipe. Do not make pipe joints in walls or slabs.
- .8 Piping in bath and shower areas shall be non-ferrous in accordance with the requirements specified in applicable section of the Specification.
- .9 Compensate for pipe expansion by the use of swing joints or expansion loops unless otherwise noted. Generally, expansion facilities are indicated on the drawings but exact expansion compensation facilities shall suit the piping as installed. Submit exact detail drawings of expansion compensation facilities in shop drawing form for review.
- .10 Provide pipe guides for all piping where required to prevent any radial movement, and provide double guides at all type expansion compensators and/or loops.
- .11 Provide anchors to secure pipe work to the structure where shown and/or specified. Anchors shall be of a size and type to securely anchor the pipe at the point shown. Submit details of anchors in shop drawing form for review.
- .12 Provide automatic air vents at the high points of all water piping systems. Install automatic air vents so that they are accessible for maintenance and in accordance with the manufacturer's instructions. Connect discharge pipe from the automatic air vents to the nearest floor drain in accordance with the Ontario Building Code.
- .13 Provide a drain valve at the base of each piping riser conveying a liquid (except drainage piping), in drain connections to equipment, in low points of horizontal piping conveying a liquid (except drainage piping), and wherever else shown and/or specified.

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- .14 Unless otherwise specified, provide a manual air vent at equipment connections, and wherever else shown and/or specified. Equip manual air vents with an air chamber consisting of a minimum 150 mm (6") long length of the same type pipe as the piping in which the air vent is required, and with a diameter one (1) pipe size smaller.
- .15 Provide unions or flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at all equipment connections, in long runs of piping at suitable regular intervals to permit removal of sections of piping, and wherever else indicated on the drawings.
- .16 Ensure that equipment and material manufacturer's installation recommendations and instructions are followed unless otherwise noted herein or on the drawings, and unless such instructions and recommendations contradict governing codes and regulations.
- .17 Carefully clean all ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.
- .18 Install piping and ductwork which shall be insulated such that they have sufficient clearance to permit insulation to be applied continuously and unbroken around the pipe or duct except at fire barriers, in which case the insulation will be terminated at each side of the fire barrier.
- .19 Inspect surfaces and structure prepared by other trades before performing your work. Verify that surfaces or the structure to receive your work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing to the Consultant. Installation of your work will constitute acceptance of such surfaces as being satisfactory.
- .20 Ensure that exposed ferrous metal products, except ductwork and piping, have at least one (1) factory prime coat of alkyd metal primer, or paint such ferrous metal products with one (1) prime coat of alkyd metal primer on the job. Clean and wire brush ferrous metal products prior to application of prime coat.
- .21 For factory applied finishes, repaint or refinish surfaces damaged during shipment, erection or construction work. Quality of repair to finish shall be equal to finish provided by equipment manufacturer.

### 3.2 PIPE JOINT REQUIREMENTS

- .1 Ream all piping ends prior to making joints.
- .2 Properly cut threads in screwed steel piping and coat male threads, unless otherwise noted, with red lead, Teflon tape or paste, or an equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than two (2) pipe threads shall remain exposed.
- .3 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove all scale and oxide from the bevels and leave same smooth and clean. Ensure that personnel doing welding work are CWB certified welders and qualified for the particular pressure application worked on, and that all tests required by governing authorities are carried out, including X-ray tests where required for certain applications.
- .4 Use Bonney Forge Ltd. or equal welding tees or welding outlet fittings for piping branches off mains, welded or socket type for pipes with welded fittings and threaded type for pipes with screwed fittings.
- .5 Make all flanged joints with Cranite Ltd. or equivalent gasket materials to suit the application, and suitable bolts and nuts. Bolts shall not be longer than the length necessary to screw the nut up flush to the end of the bolt.
- .6 Bolts used for flanged connections in all piping with a working pressure of 100 psi (690 kPa) and greater shall be ASTM A-193, Grade B-7, with heavy hexagon nuts to ASTM A-194, CL-2H.
- .7 Provide suitable washers between each bolt head and the flange and between each nut and the flange.

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- .8 A random check of bolted flanged connections will be made by the Consultant to verify that flanged connections are properly mated with no shear force acting on bolts. Supply all labour to disconnect and reconnect the selected flanged joints as directed by the Consultant. If improperly mated joints are found, remove and reinstall the affected piping at your expense so that the flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.
- .9 Unless otherwise specified, make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering.
- .10 Install type "MJ" mechanical joint fittings and couplings in accordance with the manufacturer's recommendations.
- .11 If grooved end fittings and couplings are used, ensure that the proper gaskets are used and are fully compatible with the fluid conveyed, and that all valves and piping accessories are suitable. Grooves in Schedule 40 steel pipe shall be cut and/or rolled. Grooves in Schedule 30 "Lightwall" steel pipe and in copper pipe shall be rolled. Apply fitting manufacturer supplied lubricant to gaskets prior to slipping on to pipe. Make arrangements with the coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required for pipe preparation and groove cutting and/or rolling machine operation, coupling installation, etc. Comply with manufacturer's latest published specifications, instructions and recommendations with respect to pipe, coupling and fitting preparation and installation, and support, anchoring and guiding of the grooved end piping system. For galvanized piping, touch-up damaged finish and exposed underlying surface (ie. groove) with zinc rich paint.

### 3.3 INSTALLATION OF PIPE SLEEVES

- .1 Where pipes pass through concrete and/or masonry floors, walls, the roof, and any other such construction, provide pipe sleeves.
- .2 Pipe sleeves in poured concrete slabs, unless otherwise noted, shall be minimum No. 24 USS gauge (0.635 mm thick) flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves.
- .3 Sleeves in concrete or masonry walls shall be Schedule 40 galvanized steel pipe.
- .4 Sleeves in waterproof slabs shall be lengths of Schedule 40 mild galvanized steel pipe in accordance with the detail. Provide waterproof sleeves in the following locations:
  - .1 in mechanical room floor slabs, except where on grade;
  - .2 in slabs over mechanical, fan, electrical and telephone equipment rooms or closets;
  - .3 in all floors equipped with waterproof membranes;
  - .4 in the roof.
- .5 Size sleeves, unless otherwise noted, to leave 12 mm (1/2") clearance around the pipes, or where pipe is insulated, a 12 mm (1/2") clearance around the pipe insulation.
- .6 Pack and seal the void between the pipe sleeves and the pipe or pipe insulation for the length of the sleeves as follows:
  - .1 pack sleeves in fire rated construction as specified hereinafter in the Article entitled "INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS";
  - .2 pack sleeves in non-fire rated interior construction with mineral wool and seal both ends of the sleeves with non-hardening silicone base caulking compound;
  - .3 in exterior sleeves with watertight "Link Seal" (Corrosion Service Company Ltd., Telephone No. 416-630-2600) mechanical seal assemblies installed between each sleeve and pipe;

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- .4 pack sleeves in exterior walls with lead wool or oakum and seal both ends of the sleeves water-tight with approved non-hardening silicone base caulking compound.
- .7 Where sleeves are required in masonry work, accurately locate and mark the sleeve position, and turn the sleeves over to the trade performing the masonry work for installation.
- .8 Terminate sleeves for piping which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to extend 100 mm (4") above the finished surface.
- .9 "Gang" type sleeving will be permitted only with the approval of the Consultant.
- .10 Where sleeves are provided for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of the sleeved opening to the approval of the Consultant.

### 3.4 DUCT, DAMPER AND SIMILAR MATERIAL OPENINGS

- .1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in poured concrete work, masonry, drywall and other building surfaces by the trade responsible for the particular construction in which the opening is required.
- .2 Ensure that openings for fire dampers to 350 mm (14") high are sized to suit the damper arrangement with the folding blade out of the air stream.

### 3.5 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

- .1 Prepare and submit for review and forwarding to the concrete reinforcement detailer, drawings indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum.
- .2 Begin to prepare such drawings immediately upon notification of acceptance of tender and award of contract.

### 3.6 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Where mechanical work penetrates fire rated construction, provide ULC listed and labelled firestopping and smoke seal material installed in accordance with ULC certification and manufacturers published instructions to provide a temperature and flame rated seal not less than the fire resistance rating of the surrounding wall or floor assembly.
- .2 Inspect surfaces to be firestopped and sealed prior to installing work. Report unsuitable or unsatisfactory conditions to Consultant in writing. Failure to report same shall be deemed as acceptance of conditions and surfaces.
- .3 Installation of the Work shall be carried out by approved specialist firm, employing skilled tradesmen experienced in application of firestopping and smoke seals.
- .4 Note: that the information for insulated piping penetrating fire rated construction is specified in Section 15250 and is fire rated insulation with a vapour barrier jacket, ULC listed as a firestop component for use with ULC Firestop Systems.
- .5 At all fusible link damper locations in ductwork penetrating fire rated construction, seal the perimeter of the angle iron framing on both sides of the wall or slab with ULC listed and labelled sealant material to provide a positive smoke seal.

### 3.7 INSTALLATION OF PIPE ESCUTCHEON PLATES

- .1 Provide escutcheon plates suitably secured over all exposed piping passing through walls, floors, ceilings, partitions, furrings, and similar construction in finished areas.
- .2 Install the plates so that they are tight against the building surface concerned, and ensure that the plates completely cover pipe sleeves and/or openings, except where waterproof sleeves extend above floors.

**3.8 INSTALLATION OF FASTENING AND SECURING HARDWARE**

- .1 Provide fasteners, anchors, braces and supports required to maintain installations attached to the structure or to finished floors, walls and ceilings in a secure and rigid manner, capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed products.
- .2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.
- .3 Where hangers are suspended from concrete slabs, install inserts before concrete is placed using inserts designed for the specific purpose.
- .4 Where built-in inserts are inaccessible due to subsequent installation of ducts, pipes or other installations, use anchors appropriate to the load requirements, including safety factor.
- .5 Where fastener installations are suspect, conduct on-site tests of installed fasteners, employing an independent testing laboratory acceptable to the Consultant, using properly engineered and calibrated force measuring meters.
- .6 Where the floor, wall or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure that the load is properly secured to the structure that is to support the products.
- .7 Provide reinforcing or connecting supports where required to distribute the loading to the structural components.
- .8 Do not use wood plugs and hammer impact fasteners. Anchors in floor topping fills are not acceptable. Secure anchors in floors to the structure.
- .9 Where a performance requirement is specified, submit engineering calculations and written verification signed by a registered professional engineer that the installation has been inspected and is structurally sound and in accordance with design requirements.
- .10 Fastenings which cause spalling or cracking of the structure or products to which anchorage is made are not acceptable.
- .11 Obtain the Consultant's consent before using explosive actuation fastening devices. If consent is obtained, comply with CSA A166-1975.
- .12 Space anchors within limits of load bearing or shear capacity and ensure they provide positive permanent anchorage.

**3.9 INSTALLATION OF SHUT-OFF VALVES AND CHECK VALVES**

- .1 Provide shut-off valves in piping connections to equipment, to isolate piping risers and other sections of systems as shown, and wherever else indicated on the drawings.
- .2 Provide a check valve in the discharge piping of every pump, and in piping wherever else shown.
- .3 Shut-off valves in piping where a balancing or throttling effect is required such as inlet piping to water coils shall be globe type unless otherwise noted. All other shut-off valves shall be ball type to and including 50 mm (2") diameter, butterfly type 65 mm (2-1/2") diameter or larger, or, where required, gate type.
- .4 Ball valves shall not be used in piping conveying fluid below 15 C (60 F).
- .5 Shut-off valves in natural gas piping shall be lubricated plug types for piping larger than 50 mm (2") and for piping 50 mm (2") and smaller including branch piping connections to equipment, CGA approved ball type valves.
- .6 Do not use ball or butterfly valves to replace globe valves.



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- .7 Check valves shall be swing check type installed in horizontal piping, however, provide lug body type wafer check valves in vertical piping where space conditions do not permit the use of swing type check valves in horizontal piping.
- .8 Note that discharge accessories provided with vertical in-line circulating pumps specified in Section 15700 are complete with integral check valves.
- .9 Valve stems in horizontal piping shall be pitched upward.
- .10 Locate all shut-off valves in piping such that valve handles are positioned for easy operation. Wherever possible, install shut-off valves at uniform height.

### **3.10 VALVE TAGGING AND CHART**

- .1 Attach a numbered valve tag (with service identification) to each new valve, and valves immediately at the apparatus they control. Valve tag numbering must be approved by the Consultant.
- .2 Prepare a typewritten valve tag chart or charts to list all valve tag numbers, together with a brief description of the valve operation and the valve location. Valve location shall be based on school room numbers and not the room numbers shown on the mechanical or architectural drawings. Coordinate the room numbers identifying valve locations with the Board's representative.
- .3 Frame and glaze one (1) copy of the chart or charts and affix same to a wall where later directed at the site. Prepare the valve chart or charts on Mylar and insert one (1) print in each copy of the Operating and Maintenance Manual. Chart(s) must be approved by the Consultant.
- .4 Where valves occur above suspended ceilings, provide small red stick-on markers or pins on the ceiling support members or in ceiling tiles at valve locations.
- .5 Turn the valve chart master(s) over to the Consultant.

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### 3.11 INSTALLATION OF PIPING STRAINERS

- .1 Provide strainers in piping where shown on the drawings and wherever specified herein or on the drawings.
- .2 Equip strainers 50 mm (2") diameter and larger with valved blowdown piping. Terminate blowdown piping over the nearest funnel and floor drain unless otherwise noted.
- .3 Locate all strainers so they are easily accessible for service.
- .4 Note that strainers are integral with inlet suction piping accessories specified in Section 15700 with vertical in-line pumps.

### 3.12 INSTALLATION OF PIPE HANGERS AND SUPPORTS

- .1 Provide all required pipe hangers and supports.
- .2 For insulated pipe, size the hanger or support to suit the insulated pipe and install the hanger or support on the outside of the insulation.
- .3 Support underground pipe, unless otherwise noted, on a well tamped bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind.
- .4 Support underground service penetrating building exterior walls or foundations in accordance with the requirements of the detail.
- .5 Ensure that all bedding and supports for underground pipes are flat and true and that allowances are made for pipe hubs, couplings, or other protrusions so that no voids are left between the pipe and the bedding.
- .6 Hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in PART 2 of this Section, spaced in accordance with the following schedule:

| PIPE MATERIAL | SIZE                       | PIPE HANGER OR SUPPORT SPACING                |
|---------------|----------------------------|---|
| Cast Iron     | All                        | At every joint - Maximum 2.4 m (8') Intervals |
| Steel         | To 19 mm (3/4")            | 1.8 m (6') Intervals                          |
|               | 25 mm To 150 mm (1" To 6") | 2.4 m (8') Intervals                          |
|               | 200 mm (8") & Up           | 3 m (10') Intervals                           |
| Copper        | To 25 mm (1")              | 1.8 m (6') Intervals                          |
|               | 25 mm (1-1/2") & Up        | 2.4 m (8') Intervals                          |

- .7 Unless otherwise specified support vertical pipes by means of supports specified in PART 2 of this Section at maximum 3.6 m (12') intervals or at every floor, whichever is lesser.
- .8 Support vertical cast iron hub and spigot pattern piping at the hubs by means of a clamp bolted around the pipe and anchored to the floor or wall.
- .9 Support all vertical cast iron plain end pipe (mechanical joint type), as for hub and spigot pipe but secure the clamp around the pipe under a flange integral with the pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support.
- .10 Provide roller hangers or supports for all piping 50 mm (2") diameter and larger and conveying a material 38°C (100°F) or greater where required to facilitate pipe movement due to expansion and contraction, and equip the piping with steel protection saddles at roller locations to protect the piping insulation.
- .11 Provide pipe covering shields, sized to suit insulated pipe, between insulated pipe and the pipe hanger or support for all piping not supported by roller hangers and/or supports.

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- .12 Support bare copper tubing using specially made copper or plastic coated copper tubing hangers, or provide proper plastic inserts or tape to isolate ferrous hangers and supports from contact with the bare copper tubing.
- .13 Where pipes having the same slope are grouped and a common hanger or support is used, space the hanger or support to suit the spacing requirement of the smallest pipe in the group.
- .14 Where pipes change direction, either horizontally or vertically, provide a hanger or support on the horizontal pipe not more than 300 mm (12") from the elbow. Where pipes drop from tee branches, support the tees in both directions not more than 50 mm (2") on each side of the tee.
- .15 Provide all additional structural steel channels, angles and similar accessories required for support of pipes.
- .16 Do not use perforated band, wire, chain or solid ring hangers.
- .17 Do not pierce ductwork with hanger rods, and do not support piping from ductwork or duct support hardware.

### **3.13 SUPPLY OF ACCESS DOORS**

- .1 Supply access doors to give access to all valves, cleanouts, strainers, duct access doors, and other similar mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on the drawings.
- .2 Locate access doors in walls and partitions to the Consultant's approval, and arrange mechanical work to suit. Arrange mechanical work in ceiling spaces to suit access door locations shown on the reviewed and approved Sepia prints of reflected ceiling plan drawing(s) submitted as per PART 1 of this Section.
- .3 Group piping and ductwork to ensure the minimum number of access doors is required. Access doors will be installed by the trades responsible for the particular type of construction in which the doors are required.

### **3.14 INSTALLATION OF PRESSURE GAUGES AND THERMOMETERS**

- .1 Provide pressure gauges with cocks in the following locations:
  - .1 in valved tubing across the suction, suction strainer (if applicable), and discharge piping of each circulating pump;
  - .2 in the supply and return piping connections to main coils;
  - .3 in condenser water supply and return piping connections to refrigeration machine(s);
  - .4 in chilled water supply and return piping connections to refrigeration machine(s);
  - .5 in the supply and return piping connections to hot water boilers, or in the supply and return piping headers;
  - .6 in the supply and return piping connections to water or glycol solution heat exchanger(s);
  - .7 in closed expansion tank(s);
  - .8 at the top most outlet in each standpipe fire protection system riser;
  - .9 wherever else shown and/or specified on the Drawings or in the Specification.
- .2 Provide an angle type or straight type (as required) thermometer in the following locations:
  - .1 in the supply and return piping connections to main coil(s);
  - .2 in condenser water supply and return piping connections to refrigeration machine(s);
  - .3 in chilled water supply and return piping connections to refrigeration machine(s);

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- .4 in supply and return piping to hot water boilers or in the supply and return headers;
  - .5 in supply and return piping connections to water or glycol solution heat exchanger(s);
  - .6 in supply and return piping connections to domestic hot water storage tank(s);
  - .7 in supply, return and exhaust ductwork;
  - .8 wherever else shown and/or specified herein or on the Drawings or in the Specification.
- .3 Locate and mount all instruments so they are easily readable.

### 3.15 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES

- .1 Protect all exposed rotating parts such as belts drives, couplings, fly wheels, and fan wheels on all mechanical equipment with a guard. Alternatively, where belt guards cannot be installed, provide lockable doors with metal screens around all exposed rotating parts.
- .2 Secure guards to the equipment or equipment base but do not bridge sound or vibration isolation.
- .3 Where equipment oil level gauges, oil reservoirs, grease cups or grease gun fittings are integral with the equipment but are not easily accessible for service, extend to accessible locations.

### 3.16 SUPPLY OF MOTOR STARTERS AND ACCESSORIES

- .1 Unless otherwise noted, supply a motor starter for each item of motorized equipment which you provide.
- .2 Where 3-phase starters are indicated and scheduled in motor control centre enclosures, supply the control centres complete with starters and bolt the assemblies to concrete housekeeping pads where shown.
- .3 Where package type equipment with integral starters, or equipment with starters integral in loose control panels supplied with the equipment (either by Division 15 or as part of the work of other Divisions) is fed from a motor control centre, provide a disconnect switch in the motor control centre in lieu of a starter. Refer to the starter schedule(s) for requirements.
- .4 "Line" side power wiring to motor control centres and "load" side power wiring from control centres to equipment will be done as part of the electrical work of Division 16.
- .5 Unless otherwise noted or shown on the drawings, single phase starters will be mounted adjacent to the equipment they serve and connected complete as part of the electrical work of Division 16. Hand the starters to the electrical trade at the site at the proper time.
- .6 Motor starter interlocking will be done as part of the electrical work of Division 16 in accordance with requirements specified in this Division (15), and as outlined on the starter schedule(s). Equip each starter to be interlocked with all required contacts and control connection accessories.
- .7 Provide an identification nameplate on each motor starter or disconnect located in a motor control centre or on a motor starter panel, on each individually mounted starter which you supply, and on each disconnect which is provided by Division 16 for motorized equipment which you supply.

### 3.17 IDENTIFICATION PAINTING

- .1 Provide pipe, duct and equipment identification as specified below:
- .2 Identify exposed piping and ductwork in locations as follows:
  - .1 at every end of every piping or duct run;
  - .2 adjacent to each valve, strainer, damper and similar accessory;
  - .3 at each piece of connecting equipment;

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- .4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise noted;
  - .5 at 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length;
  - .6 on each side of special valves, special fittings and branch connections;
  - .7 at least once in each room, and at least once on pipe and duct runs less than 6 m (20') in length.
- .3 Identify concealed piping and ductwork in locations as follows:
- .1 at points where pipes or ducts enter and leave shafts, pipe chases, furred spaces, and similar areas;
  - .2 at maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;
  - .3 at each access door location.
- .4 Identification for piping shall consist of minimum 200 mm (8") long painted classification colour bands, painted stencilled identification wording to identify the pipe service, and painted stencilled directional arrows to indicate direction of flow, all in accordance with CGSB Standard 24-GP-3A.
- .5 Painted stencilled letters shall be 25 mm (1") high on equipment and piping 50 mm (2") diameter and larger, 12 mm (1/2") high on piping smaller than 50 mm (2") in diameter. The colour of paint for stencilled lettering shall be white on dark colour coded bands, and black on light colour coded bands. Submit a typed list of proposed identification wording for review.
- .6 Identification for ductwork shall consist of neatly stencilled, painted 25 mm (1") high lettering to indicate the system the duct is associated with and the duct service, i.e., "SYSTEM ACS-1-SUPPLY," and stencilled directional arrows to indicate air flow. On insulated ductwork with a paintable finish apply the identification directly to the duct insulation. On uninsulated ducts apply the lettering to a rectangular painted white background. Identification paint colour shall be black.
- .7 Equipment identification wording shall be minimum 25 mm (1") high stencilled lettering and shall indicate the use of the particular pieces of equipment. Abbreviations will not be permitted.
- .8 Identify piping which is electrically traced and insulated with "ELECTRICALLY TRACED" stencilled lettering at all standard identification locations.
- .9 Note that use of Brady Ltd. or equal plastic coated cloth material colour coded markers with lettering, arrows, and waterproof adhesive backing will be permitted in lieu of painting and stencilling if the surface the marker is to be applied to is dry and sealed with clear lacquer, and clear lacquer is applied over the marker after installation.
- .10 At your option, identification for piping, may be SMS Ltd. "Coil-Mark" subsurface printed plastic pipe markers with flow arrow and alternating wording. Markers shall completely wrap around piping and secure it's self to piping 150 mm (6"), including insulation, and smaller by naturally coiling itself onto the piping. Stainless steel springs shall be used to secure markers to piping of outside diameter (including insulation) 150 mm (6") and larger. Obtain approval for identification wording prior to ordering.
- .11 Paint all natural gas piping as per Code requirements.

### 3.18 INSTALLATION OF VIBRATION ISOLATION MATERIALS

- .1 Provide vibration isolation materials for mechanical work in accordance with the schedule, details, and requirements specified herein and/or on the drawings.
- .2 Supply to the vibration isolation material manufacturer or supplier a "reviewed" shop drawing copy for each piece of equipment to be isolated, and dimensioned pipe layouts of associated piping to be isolated. Unless otherwise noted, all vibration isolation materials shall be the product of one (1) manufacturer.

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- .3 Unless otherwise indicated, install isolation materials for base mounted equipment on concrete housekeeping pad bases which extend at least over the full base and isolator area of the isolated equipment.
- .4 Block and shim all bases level so that all ductwork and piping connections can be made to a rigid system at the proper operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and the building structure.
- .5 Isolate all piping larger than 25 mm (1") diameter directly connected to motorized and/or isolated equipment with 25 mm (1") static deflection spring hangers in accordance with the following schedule:

| PIPE DIAMETER              | SPRING HANGER OR MOUNT SPACING |
|----------------------------|--------------------------------|
| TO 100 mm (4")             | First 3 Points Of Support      |
| 125 mm (5") TO 200 mm (8") | First 4 Points Of Support      |

- .6 The first point of support shall have a static deflection of twice the deflection of the isolated equipment (but maximum 50 mm [2"]).
- .7 Arrange and pay for the vibration isolation equipment manufacturer to visit the site to inspect installation of his equipment. Do any revision work required as a result of improper installation. When the vibration isolation equipment manufacturer is satisfied with the installation, obtain from him a letter stating that he has inspected the installation and that his equipment is properly installed. Forward a copy of the letter to the Consultant.

### 3.19 PIPE LEAKAGE TESTING

- .1 After new piping has been placed in position and all branch piping installed, but before the piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test all piping in the presence of governing authorities, if required, and the Consultant or his authorized representative.
- .2 Drainage & Vent Piping:
  - .1 Securely close all openings and pipe ends and fill piping with water up to the highest level, and ensure that the water stands at the same level for a minimum of two (2) hours. After the fixtures and fittings are set and the pipes connected to the building drain or drains, turn on water into all pipes, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Make a smoke test if required by the Municipality.
- .3 Domestic Water Piping:
  - .1 Test piping with cold water at a pressure of 1-1/2 times normal working pressure and maintain the pressure for a minimum of 2 hours.
- .4 Sprinkler System Piping:
  - .1 Test all system piping with cold water in accordance with requirements of NFPA No. 13, "Installation of Sprinkler Systems," and in accordance with requirements of governing authorities. Prior to the pressure test, flush the system piping to ensure that it is completely free of foreign matter.
- .5 Heating Water and Glycol Solution Piping:
  - .1 Test piping with cold water at a pressure of 1035 kPa (150 psi) for a minimum of 2 hours.
- .6 Natural Gas Piping:
  - .1 Test piping in accordance with the requirements of the latest edition of CAN-1-B149.1 and/or requirements of the Utility or Technical Standards and Safety Authority (TSSA). After completion of the verification test at the point of entry of the gas main into the building, affix Test Certificate to the pipe in a secure manner. Check all piping joints and connections for leaks with a water/soap solution while the piping is under pressure.

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- .7 General Regarding All Piping:
  - .1 Temporarily remove all piping system specialties which may be damaged by test pressures, prior to pressure testing the systems.
  - .2 When testing is carried out below the highest level of the particular system, increase the test pressure by the hydrostatic head 7 kPa (1 psi) for every 600 mm (2') below the high point.
  - .3 Include for temporary piping connections required to properly complete the tests.
  - .4 When pressure testing any system, valve off any equipment which has a working pressure lower than the system test pressure.
  - .5 Make tight all leaks found during tests while the piping is under pressure, and if this is impossible, remove and refit the piping and reapply the test until satisfactory results are obtained.
  - .6 Where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions.
  - .7 Tests may be done in sections, as later approved.
  - .8 Maintain written logs of all tests performed and keep the logs available at the site for review upon request.
  - .9 In addition to the leakage tests specified above, demonstrate proper flow throughout the systems including mains, connections and equipment, as well as proper venting and drainage. Include for any necessary system adjustments to achieve the proper conditions.

### 3.20 MECHANICAL PLANT PERFORMANCE AND ACCEPTANCE TESTS

- .1 After individual pieces of equipment have been tested and accepted, but prior to operating tests specified hereinafter, forward to the Consultant a letter stating that the entire mechanical plant is complete in all respects, has been checked and tested, and is ready for start-up. When the letter has been received, the Consultant will visit the site for purpose of witnessing a performance and acceptance test of the entire plant.
- .2 Include for all required labour for the performance test and any adjustments required due to the results of the test, and ensure that competent and qualified equipment manufacturer's representatives are present during the test.
- .3 When the entire mechanical plant is ready for acceptance, but before acceptance of same, subject the entire plant to a continuous run for the length of time required for the purpose of demonstrating that all apparatus, materials, and systems are in perfect working order, that all controls and operating services are properly adjusted, that all units are heating and/or cooling properly, and that the systems provide uniform temperatures inside the building regardless of outside temperatures or conditions. Make the tests under the direction of the Consultant, and if the plant is not in proper operating condition, the Owner reserves the right, if all defects are not properly rectified, to employ other parties to make the necessary alterations and put the systems in proper working order, at your expense.
- .4 Note that the testing specified above must be complete prior to issue of a Certificate of Substantial Performance.

### 3.21 DISCONNECTION AND REMOVAL OF EXISTING MECHANICAL WORK

- .1 Where indicated on the drawings, disconnect and remove existing mechanical work. Disconnect at the point of supply, remove obsolete connecting services and make the system safe. Cut back obsolete piping behind finishes and cap water-tight otherwise noted.
- .2 Where existing mechanical services pass through or are in an area to serve items which are to remain, maintain the services in operation. Include for rerouting existing services concealed behind existing finished and which become exposed during the renovation work, so as to be concealed behind new or existing finishes.

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- .3 Unless otherwise noted, remove from the site and dispose of all existing materials which have been removed and are not to be relocated or reused, except for the plumbing fixtures which shall be handed over to the Owner at the site.
- .4 Coordinate with the Owner for the exact plumbing fixtures required to be handed over and the places for storage.

### **3.22 ASBESTOS**

- .1 If at anytime during the course of the work asbestos containing materials are encountered or suspected, immediately cease work in area in question and proceed in accordance with of Ontario Regulation 654/85 "Regulation Respecting Asbestos On Construction Projects And In Buildings And Repair Operations". Do not resume work in affected area without written approval from the Owner.

### **3.23 INTERRUPTIONS TO AND SHUT-DOWNS OF MECHANICAL SERVICES AND SYSTEMS**

- .1 Coordinate all shut-downs and interruptions to existing mechanical systems and services with the Consultant and Owner, and perform at times acceptable to the Owner.
- .2 Upon award of Contract, submit to the Consultant a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform the Owner and Consultant in writing five (5) working days in advance of the proposed shut-down or interruption and obtain written approval to proceed. Do not shut-down or interrupt any system or service without such written approval.
- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize the shut-down time and to reinstate the systems as soon as possible, and, prior to any shut-down, ensure that all materials and labour required to complete the work for which the shut-down is required are available at the site.

### **3.24 EQUIPMENT BASES AND SUPPORTS**

- .1 Unless otherwise noted, set all floor mounted equipment on 100 mm (4") high concrete housekeeping pads 100 mm (4") wider and longer than the equipment base dimensions.
- .2 Supply dimensioned drawings, equipment base templates and anchor bolts for proper setting and securing of equipment on pads, and be responsible for all required levelling, alignment, and grouting of the equipment.
- .3 For equipment such as shell and tube heat exchangers provide prime coat painted structural steel stands flange bolted to housekeeping pads.
- .4 Provide prime coat painted structural black steel angle or channel frames and brackets for all surface wall mounted equipment not specifically designed for surface wall mounting, unless otherwise noted.

### **3.25 CONCRETE WORK FOR MECHANICAL SERVICES**

- .1 Provide all concrete work, including reinforcing and formwork, required for mechanical work. All concrete shall be minimum 20,700 kPa (3,000 psi) ready-mix concrete provided in accordance with requirements of Division 3, unless otherwise noted.

### **3.26 PIPING EMBEDDED IN CONCRETE**

- .1 Where piping is to be embedded within structural concrete, install such piping in compliance with the requirements of the latest edition of CSA Standard CAN3-A23.1, "Concrete Materials and Methods of Concrete Construction," with specific reference to Section 13.5. Generally installation practices and methods shall be confirmed with and accepted by the Structural Engineer.
- .2 Where piping is to be embedded within slabs, the following criteria shall also be followed:
  - .1 Where piping pass by a column, stay at least two times the thickness of the slab and drop away from the column;



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- .2 Where piping terminate adjacent to a column or wall, bring the piping in toward the column/wall as close as to 90° to the face of the column as possible within two times the thickness of the slab and drop away from the column;
- .3 The maximum diameter of a single piping is not to exceed one-quarter of the slab thickness and the total depth of the conduits crossing over each other is to be less than one-third the thickness of the slab;
- .4 Place piping in the middle third of the thickness of the slab. Do not allow conduit to lay directly on the reinforcing steel;
- .5 Do not allow piping to run immediately adjacent to parallel reinforcing bars;
- .6 Do not run piping longitudinally in a beam without specific approval of the Structural Engineer. Pass through beams at right angles to the span of the beam;
- .7 Where piping pass through beams, stay at lease the depth of the beam away form the supports;
- .8 Do not run piping in the slab beside a drop or beam within twice the depth of the slab from the edge of the drop or beam.

### 3.27 EXCAVATION AND BACKFILL

- .1 Do all excavation, backfill and related work required for your work. Perform such work in accordance with requirements of Division 2, except as modified by this Article. Examine the soil test report during the tender period.
- .2 Grade the bottom of trench excavations as required.
- .3 In firm, undisturbed soil, lay pipes directly on the soil.
- .4 In rock and shale, excavate to 150 mm (6") below and a minimum of 200 mm (8") to either side of the pipe, and backfill to the required invert with granular "A" material compacted to minimum 95% Standard Proctor Density.
- .5 Prepare new bedding under pipe in unstable soil, in fill, and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls and at manholes and catch basins. Compact to maximum possible density and support the pipe by 200 mm (8") thick reinforced concrete cradles spanning full length between firm supports. Install reinforcing steel in the cradles or construct piers every 2.4 m (7.87') or closer, down to solid load bearing strata. Provide a minimum of one (1) pier per length of pipe. Use the same method where pipes cross.
- .6 Where excavation is necessary in proximity to and below the level of any footing, backfill with 13,800 kPa (2,000 psi) concrete to the level of the highest adjacent footing. Proximity is determined by the angle of repose as established by the Consultant.
- .7 Provide support over at least the bottom one-third (1/3) segment of the pipe in all bedding methods. Shape the excavation to fit pipe hubs, couplings and similar items and ensure even bearing along the barrels.
- .8 Keep walls of trenches straight to at least 450 mm (18") within the pipe design limits. Have excavations inspected at least once a week by authorities. Break-up rocks and boulders and remove these by drilling and wedging. Do not use blasting unless specifically approved by the Consultant.
- .9 Before backfilling, test work for leakage and arrange for the work to be inspected by the Consultant. Remove all shoring during backfilling.
- .10 Backfill trenches within the building with clean sharp sand in individual layers of maximum 150 mm (6") thickness compacted to a density of 100% Standard Proctor. Hand compact the first layers up to a compacted level of minimum 300 mm (12") above the top of the pipe. Hand or machine compact the balance up to grade.

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- .11 Backfill trenches outside the building (not under roads, parking lots or traffic areas), up to a compacted level of 450 mm (18") thick above the pipe with granular "A" material hand compacted to a density of 95% Standard Proctor. Backfill the balance in 150 mm (6") layers with approved excavated material compacted to 95% Standard Proctor density.
- .12 Backfill trenches outside the building under roads, parking lots or traffic areas with 7 mm (1/4") crushed stone or granular "A" gravel in layers not exceeding 150 mm (6") thickness, compacted to 100% Standard Proctor density up to grade level.
- .13 Do not use water for consolidation or during compaction of backfill.
- .14 Fill all depressions to correct grade level with appropriate material, after an adequate period has passed to reveal any settlement. Use maximum possible compaction. Pay all costs required to make good all damage caused by settlement.
- .15 Dispose of surplus excavated materials as specified in Division 2.
- .16 Do pumping as required to keep excavations free of water.
- .17 The inverts and locations of existing site services shown on the drawings are approximate and it is your responsibility to confirm and satisfy yourself that the inverts and locations as shown are correct, prior to commencing work. Where discrepancies are found, immediately inform the Consultant and await a direction.
- .18 Note: You will be held responsible for any damage done to existing underground services caused by neglect to determine and mark out the location of such services prior to excavation work commencing.
- .19 Ensure that all underground water piping outside the building has a minimum of 1.37 m (4'-6") of cover.
- .20 Ensure that all underground water piping inside the building in unheated areas has a minimum of 450 mm (18") of cover.

### **3.28 FINISH PAINTING OF MECHANICAL WORK**

- .1 Unless otherwise noted, finish painting of exposed mechanical work will be done as part of the work of Division 9.
- .2 Touch-up paint pre-finished equipment and provide identification painting of conduit, duct and equipment to the Consultant's approval. Confirm colour requirements prior to ordering.

### **3.29 CUTTING AND PATCHING FOR MECHANICAL WORK**

- .1 Do all cutting and patching of the existing building for the installation of your work. Perform all cutting in a neat and true fashion, with proper tools and equipment to the approval of the Consultant. Patch surfaces, where required, to exactly match existing finishes using tradesmen skilled in the particular trade or application worked on to the approval of the Consultant.
- .2 Where new pipes pass through existing construction, core drill an opening. Size openings to leave 1/2" (12 mm) clearance around the pipes or pipe insulation.
- .3 Prior to drilling any openings, determine the location of existing services that may be concealed in the construction to be drilled. X-ray the walls or slabs at locations to be drilled. Do not drill any surface without first reviewing the location and procedure(s) with the Consultant. Include for all work related to X-raying of walls or slabs.
- .4 You will be responsible for the repair of any damage to existing services, exposed or concealed, caused as a result of your cutting or drilling work.

## SECTION 15050 – MECHANICAL BASIC MATERIALS AND METHODS

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- .5 Note: Where drilling is required in waterproof slabs, size the opening to permit snug installation of a pipe sleeve which is sized to leave ½" (12 mm) clearance around the pipe or pipe insulation. Provide a pipe sleeve in the opening. Pipe sleeves shall be Schedule 40 galvanized steel pipe with a flange at one (1) end and a length to extend 4" (100 mm) above the slab. Secure the flange to the underside of the slab and caulk the void between the sleeve and slab opening with proper non-hardening silicon base caulking compound to produce a water-tight installation.

### 3.30 PACKING AND SEALING CORE DRILLED PIPE OPENINGS

- .1 Pack and seal the void between the pipe opening and the pipe or pipe insulation for the length of the opening as follows:
- .1 pack openings in non-fire rated interior construction with mineral wool and seal both ends of the opening with non-hardening silicone base caulking compound to produce a water-tight seal;
  - .2 pack and seal openings in fire rated walls and slabs as specified in this Section in the Article entitled "INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS";
  - .3 pack openings in exterior walls with lead wool or oakum and seal both ends of the opening water-tight with approved non-hardening silicone base caulking compound.

### 3.31 INSTRUCTIONS TO OWNER

- .1 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of systems and equipment specified in succeeding Sections of this Division of the Specification. Obtain in writing from the Consultant a list of the Owner's representatives to receive instructions.
- .2 Arrange and pay for the services at the site of qualified technicians and other manufacturer's representatives to instruct on specialized portions of the installation.
- .3 Submit to the Consultant prior to application for a Certificate of Substantial Performance, a complete list of systems for which instructions were given, stating for each system:
- .1 date instructions were given to the Owner's staff;
  - .2 duration of instructions;
  - .3 names of persons instructed;
  - .4 other parties present (manufacturer's representatives, etc.).
- .4 Obtain the signatures of the Owner's staff to verify they properly understood the system installation, operation and maintenance requirements and have received operating and maintenance manuals

### 3.32 INSTALLATION OF IDENTIFICATION NAMEPLATES

- .1 For each piece of mechanical equipment, provide nameplates.
- .2 Where nameplate cannot be satisfactorily attached with adhesive, provide a nylon tie to attach the nameplate.

### 3.33 MOTOR STARTER SCHEDULES

- .1 Motor Starter Schedules "SS-01" to "SS-06" inclusive are included at the end of this Section of the Specification and forms an integral part of this Section.

**END OF SECTION 15050**

## **SECTION 15250 – INSULATION**

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## **SECTION 15250 – INSULATION**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 Section 15010 in this Division of the Specification applies to and is a part of this Section of the Specification.
- .2 Section 15050 in this Division of the Specification applies to and is a part of this Section of the Specification. The Section contains requirements, products, and methods of execution that apply to this Section as well as to other Sections of Division 15.

#### **1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 The following work which is related to the insulation work is specified in other Sections of the Specification:
  - .1 plumbing and drainage piping and equipment;
  - .2 liquid heat transfer system piping and/or equipment;
  - .3 refrigeration system piping and/or equipment;
  - .4 supply of insulation accessories for circuit balancing valves;
  - .5 air handling equipment and accessories;
  - .6 ductwork, casings, plenums and similar sheet metal work.
  - .7 supply of insulation accessories for circuit balancing valves;
  - .8 electric heating cable for pipe and/or equipment piping.

#### **1.3 SAMPLES**

- .1 Submit to the Consultant for approval, a sample of each type of insulation, in applied form. Mount the samples on a rigid plywood board. Identify each sample with the manufacturer's name and insulation type, and the proposed use of the insulation. The sample board shall be provided in shop drawing form. Accompanying the sample board shall be complete, up to date literature from the manufacturer for each product. It shall be understood that any and all insulation supplied and/or installed on the project shall be in accordance with the reviewed sample board.

#### **1.4 VAPOUR BARRIER JACKET**

- .1 Insulation specified with a vapour jacket, shall be supplied with the vapour barrier jacket factory installed. Installation of a vapour barrier jacket outside of the insulation manufacturer's factory is not acceptable and will be considered deficient work. Contractor and manufacturer shall certify in writing that vapour barrier jacketed insulation supplied and installed on the work is in accordance with this stipulation.

### **PART 2 - PRODUCTS**

#### **2.1 FIRE HAZARD RATINGS**

- .1 Unless otherwise noted, all insulation system materials must meet requirements of NFPA 90A, and must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with CAN/ULC 4-S102-M.

#### **2.2 THERMAL PERFORMANCE**

- .1 Unless otherwise noted, thermal performance (i.e. conductivity) of insulation shall meet or exceed the values given in Table 6.8.2.A, 6.8.2.B and 6.8.3 of the ASHRAE/IES Standard 90.1-2004.

## SECTION 15250 – INSULATION

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### 2.3 PIPE INSULATION MATERIALS

- .1 Johns-Manville, "MICRO-LOK" rigid, moulded, sectional glass fibre pipe insulation with a factory applied "AP-T" vapour barrier jacket.
- .2 Johns-Manville, "MICROLITE" flexible blanket type glass fibre insulation.
- .3 Owens Corning, No. MP-105, factory formed glass fibre insulation for pipe fittings, valves, and similar items.
- .4 Pittsburg Corning Corporation "FOAMGLAS," rigid, moulded sectional cellular glass pipe insulation.
- .5 Armstrong World Industries Canada Ltd., "AP Armaflex" flexible, elastomeric, 25/50 rated closed cell fire-retardent pipe insulation.
- .6 Instant Firestop Inc., "PI" or equal, non-combustible, fire-rated, sectional longitudinally split pipe insulation with a reinforced vapour barrier jacket, ULC listed and labelled as a component in a firestop system assembly.

### 2.4 EQUIPMENT INSULATION MATERIALS

- .1 Johns-Manville, "Pipe and Tank" flexible, fibreglass blanket, insulation bonded to a non-woven fibreglass mat backing.
- .2 Johns-Manville "Pipe and Tank - AP" flexible, fibreglass blanket type insulation bonded to a type "AP" vapour barrier backing.
- .3 Armstrong World Industries Canada Ltd., "WPARMAFLEX" flexible, elastomeric, 2550 rated closed-cell fire retardant sheet insulation.

### 2.5 DUCTWORK SYSTEM INSULATION MATERIALS

- .1 Johns-Manville, "800 Series Spin Glass - FSK," rigid fibreglass insulation with a factory applied, glass fibre reinforced, foil and flame retardant kraft paper vapour barrier facing.
- .2 Johns-Manville, "Microlite – FSK" flexible, blanket type fibreglass insulation with a factory applied, glass fibre reinforced, foil and flame retardant kraft paper vapour barrier facing.
- .3 Armstrong World Industries Canada Ltd., "AP Armaflex" flexible elastomeric 25/50 rated closed cell fire retardant sheet insulation.

### 2.6 INSULATION FINISH MATERIALS

- .1 S. Fattal Canvas Inc., ULC listed and labelled "Thermocanvas," with an ASTM flame spread rating of less than 25 and a smoke developed rating of less than 50.
- .2 Childers Products Company, "Rolled Jacketing" embossed or smooth, 0.40 mm (.016") thick, aluminum insulation jacket selected internal vapour barrier to suit application and matching prefabricated fitting covers.
- .3 CCX Fabric "Glass-Fab", or equal, 20-10 weave fibreglass mesh.
- .4 Pipe insulation jacket and fitting covers – The Sure-Fit System "SMOKE-LESS 25/50" 15 MIL thick, gloss white PVC pipe insulation jacket and fitting covers with manufacturer supplied adhesive and PVC tape.

### 2.7 LAGGING ADHESIVE

- .1 BAKOR No. 120-09, or equal, fire resistive resin emulsion, heavy duty lagging coating rated 25/50 per ASTM E84, suitable for indoor and outdoor use.

### 2.8 INSULATION CEMENTS

- .1 Asbestos free, hydraulic setting insulating and finishing cement.

## SECTION 15250 – INSULATION

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### 2.9 INSULATION ADHESIVES

- .1 Fibrous insulation - BAKOR No. 200-37, rubberized emulsion based, waterproof adhesive, fire resistive when dry, non-flammable when wet and 0/0 rated per CAN/ULC4-S102.
- .2 Flexible elastomeric insulation – Armstrong World Industries Canada Ltd., No. 520 synthetic based adhesive, 5/15 rated per ASTM E84.

### 2.10 INSULATION ACCESSORIES

- .1 Insulation protection shields - Grinnel Corporation Fig. No. 167, or equal, galvanized carbon steel insulation protection shield to MSS SP-69 and designed for a maximum of 4 psi (27.6 kPa) compressive stress based on a 10' (3.0 m) span between supports or hangers.
- .2 Wire - No. 15 gauge (1.8 mm [.072"] diameter) galvanized annealed wire.
- .3 Twine - Jute or fibrous glass twine.
- .4 Mesh - 25 mm (1") hexagonal mesh constructed of No. 15 gauge (1.8 mm [.072"] diameter) galvanized annealed wire.
- .5 Aluminum strap – 12 mm (1/2") wide, 0.5 mm (0.020") thick aluminum strapping.
- .6 Steel strap - 12 mm (1/2") wide, 0.4 mm (0.015") thick, galvanized steel strapping.
- .7 Fitting covers – The Sure-Fit System "SMOKE-LESS 25/50" 15 MIL thick, gloss white PVC fitting covers with manufacturer supplied adhesive and PVC tape.
- .8 Pins and clips - No. 14 gauge (2 mm [.080"] diameter) weld-on pins with 32 mm (1-1/4") square plated metal type or round nylon clips.
- .9 Cloth tape - Fiberglas Canada Inc., fibreglass reinforced cloth.
- .10 Mactac Canada Ltd. – pressure sensitive tape sealant type FSK-1 (foil/scrim/Kraft) or ASJ (All Service Jacket) to suit insulation vapour barrier material type.

### 2.11 ACCEPTABLE INSULATION MANUFACTURERS

- .1 Acceptable insulation and insulation manufacturers are as follows:
  - .1 fibreglass insulation - Johns-Manville, Manson, Knauf and Owens Corning Canada Inc.;
  - .2 flexible elastomeric insulation – Armstrong World Industries Canada Ltd. and Rubatex;
  - .3 canvas jacketing material - S. Fattal Canvas Inc. and Robson Thermal Mfg. Ltd.;
  - .4 aluminum jacketing material - Childers Product Company and Permaclad Products;
  - .5 PVC fitting covers and jacketing material – The Sure-Fit System.

## PART 3 - EXECUTION

### 3.1 GENERAL INSULATION APPLICATION REQUIREMENTS

- .1 Unless otherwise noted, do not insulate the following:
  - .1 factory insulated equipment and piping;
  - .2 heating piping within radiation unit enclosures, including blank filler sections of enclosures;
  - .3 branch domestic water piping located under counters to serve counter mounted plumbing fixtures and fittings;
  - .4 exposed chrome plated domestic water angle supplies from concealed piping to plumbing fixtures and fittings;

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- .5 heated liquid system pump casings;
- .6 expansion tanks;
- .7 condenser water supply and return piping inside the building;
- .8 manufactured expansion joints and flexible connections;
- .9 acoustically lined ductwork and/or equipment;
- .10 flexible ductwork.
- .2 Install insulation directly over pipes and not over hangers and supports.
- .3 Do not apply insulation until leakage tests have been satisfactorily completed.
- .4 Ensure that all surfaces to be insulated are clean and dry.
- .5 No material including tapes, adhesives, etc. used as part of an insulation assembly shall be rated greater than 25/50 Article 2.1 entitled "FIRE HAZARD RATING OF INSULATION" shall be used within a "plenum" as defined in OBC.
- .6 Install work generally in accordance with TIAC "NATIONAL INSULATION STANDARDS MANUAL" except conform with manufacturer's published instructions and recommendations and the requirements specified herein this Section of the Specification.
- .7 Ensure that the ambient temperature is minimum 13°C (55°F) for at least one (1) day prior to the application of insulation, and for the duration of insulation work.
- .8 Where piping and/or equipment is traced with electric heating cable, ensure that the cable has been tested and approved prior to the application of insulation and ensure that the cable is not damaged or displaced during the application of insulation.
- .9 Install piping insulation continuous through pipe openings and sleeves.
- .10 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.
- .11 Provide proper covering shields, sized to suit the insulated pipe, between the pipe hanger or support and the insulation for all piping not supported by roller hangers or supports.
- .12 Where roller hangers and supports are used, steel protection saddles will be supplied and installed as part of the piping work. Pack the saddle voids with fibreglass insulation.
- .13 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect the insulation jacketing from the action of condensation at its junction with the metal.
- .14 The final appearance and finish of exposed mechanical work depends to a large degree on the quality of the insulation application, therefore, first class workmanship will be insisted upon.
- .15 For all piping system components and for equipment or sections of equipment which require insulation but also access to permit maintenance or adjustment, design and install the insulation to permit easy removal and replacement.
- .16 For items such as "circuit balancing valves" which are supplied with insulating accessories, specified in other Sections of the Specification, incorporate the packing into the pipe insulation, but do not contravene fire hazard ratings of CAN4-S102.

### 3.2 PIPE INSULATION REQUIREMENTS - FIBREGLASS

- .1 Except where other types of insulation are specified for portions of piping in succeeding articles in this Section, insulate the following pipe with rigid fibreglass pipe insulation of the thickness noted:
  - .1 domestic cold water piping, supply and return - 25 mm (1") thick;



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- .2 domestic hot water piping, supply and return, to and including 50 mm (2") diameter - 25 mm (1") thick;
- .3 domestic hot water piping, supply and return, larger than 50 mm (2") diameter - 38 mm (1-1/2") thick;
- .4 exposed drainage piping (including trap) from all wheelchair lavatories equipped with offset waste fittings – 12 mm (1/2") thick;
- .5 condensate drainage piping from split AC indoor unit drain pans to main vertical risers ½" (12 mm) thick;
- .6 storm drainage piping from roof drains to the point where main vertical risers extend down, without offsets and connect to horizontal mains – 25 mm (1") thick;
- .7 glycol solution heating, supply and return, to and including 100 mm (4") diameter - 38 mm (1-1/2") thick;
- .8 glycol solution heating, supply and return, larger than 100 mm (4") diameter - 50 mm (2") thick;
- .9 hot water heating piping, supply and return, to and including 100 mm (4") diameter - 38 mm (1-1/2") thick;
- .10 hot water heating piping, supply and return, larger than 100 mm (4") diameter - 50 mm (2") thick;
- .11 all sanitary and storm drainage piping, domestic water, heating water, chilled water, condenser water, fire protection system piping located in unheated areas and indicated on the drawings to be traced with electric heating cable – 50 mm (2") thick;
- .12 boiler feedwater piping complete – 2" (50 mm) thick;
- .13 boiler blowdown piping complete – 2" (50 mm) thick;
- .2 Provide cellular glass pipe insulation extended a minimum of 50 mm (2") beyond ends of insulation shield at all hanger and support locations for piping 50 mm (2") diameter and larger and not equipped with pipe saddles. Where pipe insulation is covered by a vapour barrier jacket, wrap the cellular glass insulation with same vapour barrier jacket material overlapped a minimum of 25 mm (1") on to the adjacent pipe insulation's jacket.
- .3 Secure overlap flap of the jacketed insulation in place with a full coverage of adhesive. Firmly butt together sections of the insulation and cover the butt joints with 75 mm (3") wide factory supplied strips of the vapour barrier jacket material secured in place with adhesive.
- .4 Pre-formed glass fibre fitting insulation should be used at pipe fittings, valves, etc. Cover fitting insulation with the same sectional pipe insulation jacket material laminated in place with adhesive.

### 3.3 PIPE INSULATION REQUIREMENTS - FIRE RATED INSULATION

- .1 Where pipe which is to be insulated as specified above penetrates fire rated walls and slabs, provide fire rated, ULC listed, non-combustible sectional insulation on the portion of pipe in the fire barrier and for a distance of 50 mm (2") on either side of the fire barrier. Insulation thickness shall be as specified, but in any case minimum 25 mm (1").

### 3.4 PIPE INSULATION REQUIREMENTS FLEXIBLE ELASTOMERIC

- .1 Except where types of insulation are specified for portion of piping in succeeding articles in this section. Insulate the following pipe with closed cell flexible elastomeric type insulation of the thickness noted:
  - .1 refrigerant piping inside the building – 12 mm (1/2") thick;
  - .2 refrigerant piping outside the building – 20 mm (3/4") thick.

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- .2 Install flexible elastomeric pipe insulation in strict accordance with the manufacturer's published instructions and recommendations.
- .3 Cover exposed elastomeric pipe insulation with adhesive supplied by the insulation manufacturer.

### 3.5 EQUIPMENT INSULATION REQUIREMENTS

- .1 Insulate the following equipment with fibreglass blanket type insulation with vapour barrier backing of the thickness noted:
  - .1 roof drain bodies where inside the building - 38 mm (1-1/2") thick;
  - .2 domestic cold water pump casings – 38 mm (1-1/2") thick.
  - .3 water meter – 38 mm (1-1/2") thick.
- .2 Install the equipment with insulation to a thickness and insulating value equal to an equivalent thickness of sectional pipe insulation. Laminate the insulation in place with adhesive and secure with wire or twine. Apply a jacket of the insulation vapour barrier material secured in place with adhesive.
- .3 Insulate the following equipment with blanket type fibreglass insulation without vapour barrier backing of the thickness noted:
  - .1 domestic hot water storage tanks – 88 mm (3-1/2") thick;
  - .2 heating converters or exchangers – 50 mm (2") thick.
- .4 Provide removable and replaceable insulated metal covers for all equipment with removable heads.

### 3.6 DUCTWORK SYSTEM INSULATION REQUIREMENTS - FIBREGLASS

- .1 Insulate the exterior of the following ductwork systems with rigid board type fibreglass insulation of the thickness noted:
  - .1 all fresh air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to and including the first heating coil section, or, if both mixing plenums or sections and heating coil sections are not provided, then the fresh air ductwork system complete - 38 mm (1-1/2") thick;
  - .2 mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated - 25 mm (1") thick;
  - .3 supply ductwork outward from fans, except for branch supply ductwork exposed in the area it serves - 25 mm (1") thick;
  - .4 exhaust discharge ductwork for a distance of 3 m (10') upstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10') distance - 25 mm (1") thick;
  - .5 any other ductwork, casings, plenums, or sections as specified on the drawings - thickness as specified.
- .2 Insulation for casings, plenums and exposed rectangular ductwork shall be rigid board type. Insulation for round ductwork and concealed rectangular ductwork shall be blanket type.
- .3 Securely butt together adjoining sections of insulation. Secure the insulation in place with a full coverage of adhesive on all surfaces, and on vertical and suspended surfaces with pins welded to the ductwork on 300 mm (12") to 450 mm (18") centres with the insulation applied overtop the pins and secured in place with clips. Ensure that the insulation does not sag or bulge.
- .4 Make joints in vapour barrier facings with 75 mm (3") wide overlap strips of the insulation vapour barrier facing secured in place with a full coverage of adhesive.

## SECTION 15250 – INSULATION

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- .5 Insulate silencers located in ductwork systems to be insulated, to the same insulation standard as the ductwork.
- .6 Provide dry wall type metal corner beads on edges of exposed rectangular ductwork, casings and plenums in equipment rooms, service corridors and any other area where the insulation is subject to accidental damage.

### 3.7 DUCTWORK SYSTEM INSULATION REQUIREMENTS- FLEXIBLE ELASTOMERIC

- .1 Insulate all exposed ductwork and associated plenums or casings outside the building with 1" (25 mm) thick closed cell flexible elastomeric sheet insulation applied in two (2) ½" (12 mm) thick layers with staggered joints.
- .2 Install flexible elastomeric sheet insulation in strict accordance with the manufacturer's published instructions and recommendations to produce a weatherproof installation. Seal sheet metal work joints watertight with duct sealer prior to applying insulation.

### 3.8 INSULATION FINISH REQUIREMENTS

- .1 Except as otherwise specified, jacket all exposed fibreglass insulation work inside the building with canvas secured with a full 100% covering coat of lagging adhesive. Neatly trim all canvas joints and shrink the canvas tight in place.
- .2 At your option, exposed fibreglass insulation inside the building may be jacketed with PVC fitting and jacketing installed and sealed in accordance with the manufacturer's instructions to produce a watertight finish. Do not mix finishing methods in order to maintain uniformity of finish.
- .3 Cover exposed elastomeric insulation with glass mesh fully, and tightly secured to the insulation with adhesive supplied by the insulation manufacturer. Neatly trim glass mesh.
- .4 Protect insulation on exposed piping and ductwork penetrating mechanical room floors with sheet steel or aluminum jacketing for a distance of 1 m (3') above the floor level.
- .5 Jacket all insulation outside the building with aluminum jacketing with prefabricated fitting covers. Install in accordance with manufacturer's published instructions. Confirm vapour barrier requirements prior to ordering.
- .6 Seal all fibreglass insulation outside the building with canvas jacket lagged in place with waterproof adhesive (coating), then apply two (2), heavy, 100% covering coats of weather-proof lagging coating and apply two (2) coats of coloured weatherproof decorative finish. Confirm finish colour prior to ordering. Alternatively, jacket the pipe insulation with an aluminum jacket with internal vapour barrier secured in place with aluminum bands on 18" (450 mm) centres and with 2" (50 mm) overlap (or as otherwise stated in manufacturer's published instructions) at butt joints and longitudinal seams to produce a completely weatherproof and water-tight installation.
- .7 Unless otherwise specified, finish all exposed flexible elastomeric insulation work with two (2) coats of finish supplied by the insulation manufacturer. Apply the finish in accordance with the manufacturer's recommendations and instructions. Confirm finish colour requirement(s) and tint finish in accordance with manufacturer's direction to Consultant's colour scheme.

**END OF SECTION 15250**

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- 3.13 VIDEO INSPECTION OF DRAINAGE PIPING

**PART 1 - GENERAL****1.1 REFERENCES**

- .1 Section 15010 in this Division of the Specification applies to and is a part of this Section of the Specification.
- .2 Section 15050 in this Division of the Specification also applies to and is a part of this Section of the Specification. The Section contains requirements, products, and methods of execution that apply to this Section as well as to other Sections of Division 15.

**1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 The following work which is related to the plumbing work is specified in other Sections of the Specification:
  - .1 Provision of underground drainage and water service piping outside the building and to a point 5' (1.5 m) outside building lines;
  - .2 Mounting and flashing only (in roof areas) of roof drain bodies;
  - .3 Provision of site applied thermal insulation for plumbing work;
  - .4 Plumbing fixtures and fittings;
  - .5 Installation of vent stack roof flashing accessories;
  - .6 Provision of washroom accessories including grab bars;
  - .7 Installation of vent stack roof flashing accessories;

**1.3 SHOP DRAWINGS**

- .1 Submit shop drawings for all plumbing materials and equipment specified PART 2 of this Section except drainage piping cleanouts, vacuum breakers, chlorine, and standard shut-off and check valves.
- .2 Submit certified performance curves with all pump shop drawings.

**PART 2 - PRODUCTS****2.1 VENT PIPING ROOF FLASHING ACCESSORY**

- .1 Lexsuco Canada Ltd., spun aluminum, vandal-proof, vent stack covers each complete with a hooded sleeve and an insulation sleeve all sized to suit the vent stack.
- .2 Acceptable manufacturers are Lexsuco Canada Ltd. and Thaler Metal Industries Ltd.

**2.2 DRAINAGE PIPING CLEANOUTS**

- .1 TY fittings, with extra heavy brass plugs screwed into the fittings.
- .2 Smith No. 4500 or equal, enamelled cast iron cleanout tees, each complete with a large access opening and gasketed removable cover with stainless steel hardware.
- .3 Bronze or copper cleanout tees each complete with a bronze ferrule.
- .4 Acceptable manufacturers are J.R. Smith, Watts industries and Zurn Industries Canada Ltd.
- .5 Owens – Illinois "Kimax" glass Ty cleanout fittings or cleanout tee with covers.

**2.3 CLEANOUT TERMINATIONS**

- .1 Unless otherwise specified, J.R. Smith, oven cured epoxy enamel coated cast iron, adjustable, gasketed cleanout terminations each complete with captive stainless steel screws and a cover to suit the floor finish.
- .2 Acceptable manufacturers are J.R. Smith, Watts industries and Zurn Industries Canada Ltd.

**2.4 DRAINS**

- .1 Unless otherwise specified, J.R. Smith, oven cured, epoxy coated cast iron body drains as specified on the drawing symbol list, each meeting requirements of CAN3-B79-M79 and complete with all required accessories.
- .2 Acceptable manufacturers are J.R. Smith, Watts industries and Zurn Industries Canada Ltd.
- .3 Duriron of Canada Ltd., 5501 Series, high silicon content, cast iron floor drains and traps as specified on the drawing symbol list.
- .4 All drains connected with sanitary drainage piping and equipped with traps shall be complete with a 1/2" (12 mm) diameter trap primer tapping.

**2.5 ELECTRONIC TRAP PRIMING MANIFOLD**

- .1 P.P.P. Inc. Model PT, Electronic Trap Priming Manifold, where four or more traps requiring priming within 30.8m proximity to each other, the unit shall supply a minimum of 0.3L of water per opening, in each 24 hour period or as selected with adjustable recycle timer on a 24 hour period based on a system pressure of 421kpa. Factory assembled with a bronze body ball valve, water hammer arrestor, solenoid valve, atmospheric vacuum breaker and a type L copper manifold c/w compression fitting. Electric single power point connection 120v. 1 amp. manual override switch, all encased within a 16 gauge steel cabinet with removable door.
- .2 Acceptable manufacturers are P.P.P. Inc., Watts industries and Zurn Industries Canada Ltd.

**2.6 WATER HAMMER ARRESTORS**

- .1 J.R. Smith 5000 Series, all stainless steel construction shock absorbers, each with a pre-charged air chamber of nesting steel bellows, and each sized to suit the connecting pipe size and the equipment it is provided for.
- .2 Acceptable manufacturers are J.R. Smith, P.P.P. Inc., Watts industries and Zurn Industries Canada Ltd.

**2.7 HOSE BIBBS**

- .1 Hose bibbs shall be:
  - .1 On exterior walls and unheated areas such as garbage rooms - J.R. Smith bronze flush mounted non-freeze type with box complete with vacuum breaker and identified key as specified on the drawing;
  - .2 In interior spaces - Chicago Faucets No. 5T-E27 with male inlet, hose thread outlet, removable handle, and spout outlet in-line vacuum breaker with threaded inlet and outlet.
- .2 Acceptable manufacturers are J.R. Smith, Watts industries and Zurn Industries Ltd.

**2.8 WATER PRESSURE REDUCING VALVES**

- .1 Watts Industries (Canada) Inc., Series U5B, adjustable, bronze body pressure reducing valve with a high temperature resisting diaphragm, removable stainless steel seat and built-in thermal expansion by-pass check valve.

.2 Singer Valve Co. Ltd., series 106-PR, pilot operated, adjustable, pressure reducing valve as specified on the drawing(s), complete with a bronze globe valve modulated by a diaphragm which in turn is operated by the pilot.

.3 Acceptable manufacturers are Singer Valve Co. Ltd., Braukman Controls Co. Ltd., Watts Industries (Canada) Inc. and Spirax Sarco Canada Ltd.

### **2.9 WATER PIPING VACUUM BREAKER**

.1 Watts Industries (Canada) Inc., No. NF8 vacuum breaker to CAN/CSA-B64.2-94.

.2 Acceptable manufacturers are Watts Industries (Canada) Inc., Hersey Products Inc. and Zurn Industries "Wilkins Division".

### **2.10 WATER PIPING BACKFLOW PREVENTER**

.1 Watts Regulator of Canada Ltd., No. 009, CSA certified, testable, continuous pressure type backflow preventer with a brass body, stainless steel working parts, an integral strainer, and an intermediate atmospheric vent.

.2 Watts Regulator of Canada Ltd., No. 909 Series, testable, reduced pressure principle, CSA certified, all bronze backflow assembly complete with two (2) independent check valves, intermediate relief valve, inlet strainer and inlet and outlet shut-off valves.

.3 Acceptable manufacturers are Watts Industries (Canada) Inc., Hersey Products Inc. and Zurn Industries "Wilkins Division".

### **2.11 RECIRCULATING CIRCUIT BALANCING VALVES**

.1 S.A. Armstrong Ltd., Series "CBV-S" soldered end, or "CBV-T", threaded end, globe style, bronze bodied, circuit balancing valves, suitable in all respects for potable water service, designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, valved ports for connection to a S.A. Armstrong Ltd. Model CBVM 135/60 or equal, differential pressure meter and an insulation accessory meeting the requirements of article entitled "Fire Hazard Ratings", of Section 15250.

.2 Acceptable manufacturers are S.A. Armstrong Ltd., Tour & Andersson, Danfoss and Newman-Hattersley.

### **2.12 WATER METER**

.1 Schlumberger Industries, "Neptune HP Trident Turbine" water meter with bronze casing, turbine type element and roll sealed, magnetically driven register with clear polycarbonate crystal. Meter shall conform with the requirements of AWWA Standard C701.

.2 Acceptable manufacturers are Schlumberger Industries (Neptune Water Division), Hersey Measurement Company and Canadian Meter Co. Ltd.

### **2.13 CHLORINE**

.1 Sodium hypochlorite to AWWA B300-75.

### **2.14 SUMP SUBMERSIBLE SUMP PUMPS**

.1 Hydr-O-Matic Pump Co. submersible sump pumps as scheduled on the drawings, complete with:

.2 a cast iron pump casing, motor cover and pressure switch housings;

.3 an oil filled;

.4 a non-clog impeller threaded to a corrosion protected steel shaft with mechanical shaft seal;

.5 an enclosed diaphragm type water level control pressure switch with Buna-N rubber diaphragm.

- .6 The prewired power cord with plug must be of sufficient length to extend through the sump pit conduit to the wall mounted pump receptacle. No electrical connections and outlets will be allowed in the sump.
- .7 Acceptable manufacturers are Hydr-O-Matic Pump Co. (Scarboro Pump Manufacturing), F.E. Myers (Canada) Ltd., and GSW Pump Company Barnes Pump.

## 2.15 DRAINAGE PIT FRAMES AND COVER PLATES

- .1 Heavy-gauge structural steel frames of welded fabrication, shop cleaned and prime coat painted complete with bolt holes to match coverplates bolts and concrete anchors as required:
- .2 Heavy-gauge black steel plate coverplates, reinforced as required, and complete with a non-skid top surface. Coverplates for sanitary drainage pits shall be gasketed and air-tight.

## 2.16 REFERENCES

|                                |   |  |
|--------------------------------|---|--|
| ANSI/ASME B1.20.1-1983 (R1992) | - | Pipe Threads, General Purpose (Inch)   |
| ANSI/ASME B16.3-1992           | - | Malleable-Iron Threaded Fittings   |
| ANSI/ASME B16.5-1988           | - | Pipe Flanges and Flanged Fittings  |
| ANSI/ASME B16.9-1993           | - | Factory-Made Wrought Steel Butt-welding Fittings   |
| ASTM A53-90b                   | - | Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless                             |
| ASTM A105-M92                  | - | Specification for Forgings, Carbon Steel, for Piping Components  |
| ASTM A181-M90                  | - | Specifications for Forgings, Carbon Steel For General Purpose Piping   |
| ASTM A197-87 (1992)            | - | Specifications for Cupola Malleable Iron   |
| ASTM A234-M92a                 | - | Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures |
| ASTM A307-92a                  | - | Specifications for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength                                     |
| ASTM B62-90                    | - | Specification for Composition Bronze or Ounce Metal Castings   |

## 1 Buried Piping

### 1.1 NPS 3" and Smaller

- 1.1.1 Schedule 80 ERW or CW carbon steel conforming to ASTM A53 Grade B, with plain ends and factory applied Shaw "Yellow Jacket" of 22 mil minimum thickness polyethylene.

### 1.1.2 Fittings

- 1.1.2.1 Class 3000 forged steel socket welding conforming to ASTM A105 Grade 2.
- 1.1.2.2 Protect joints and fittings with Shaw "Shrink Sleeves", or a coating of Denso Paste wrapped with Denso Tape applied with not less than 50% overlap.

### 1.2 NPS 4" and Larger

#### 1.2.1 Pipe

- 1.2.1.1 Schedule 40 ERW or CW carbon steel conforming to ASTM A53 Grade B with bevelled ends and factory applied Shaw "Yellow Jacket" of 22 mil minimum thickness polyethylene.

#### 1.2.2 Fittings

- 1.2.2.1 Schedule 40 carbon steel butt-welding fittings conforming to ASTM A234 WPB Grade B and ANSI/ASME B16.9.
- 1.2.2.2 Protect joints and fittings with Shaw "Shrink Sleeves", or a coating of Denso Paste wrapped with Denso Tape applied with not less than 50% overlap.



- 2 Aboveground Piping**
- 2.1 **NPS 3" and Smaller**
- 2.1.1 **Pipe**
- 2.1.1.1 Schedule (40) (80) ERW or CW carbon steel conforming to ASTM A53 Grade B with threaded ends.
- 2.1.2 **Fittings**
- 2.1.2.1 Class 150 banded malleable iron, screwed conforming to ASTM A197 and ANSI/ASME B16.3.
- 2.1.3 **Unions**
- 2.1.3.1 Class 150 malleable iron with screwed ends and brass to iron ground joint, conforming to ASTM A197 and ANSI/ASME B1.20.1.
- 2.2 **NPS 4" and Larger**
- 2.2.1 **Pipe**
- 2.2.1.1 Schedule 40 up to and including NPS 10" and sch. 30 or standard weight for NPS 12" and over, ERW or CW black carbon steel pipe conforming to ASTM A53 Grade B with bevelled ends.
- 2.2.2 **Fittings**
- 2.2.2.1 Seamless carbon steel butt welding fittings conforming to ASTM A234 WPB and ANSI/ASME B16.9 with wall thickness to match pipe.
- 2.2.3 **Flanges**
- 2.2.3.1 Class 150 forged steel slip-on or welding neck type, raised face conforming to ASTM A181 Grade 1 and ANSI/ASME B16.5. Bore of welding neck flanges to suit inside diameter of pipe. Flat face flanges required at cast iron valves.
- 2.2.4 **Gaskets**
- 2.2.4.1 1.6 mm (1/16") thick, Garlock No. 3200 with SBR binder or equivalent asbestos-free material manufactured by Anchor.
- 2.2.5 **Bolts**
- 2.2.5.1 Semi-finished hex head machine bolts, and semi-finished hex nuts, each of carbon steel conforming to ASTM A307 Class A.
- 2.2.6 **Valves**
- 2.2.6.1 Provide bronze valves with bodies made of bronze conforming to ASTM B62.
- 2.2.6.2 Use gate and globe valves of a design which permits valve to be re-packed under pressure, when fully open.
- 2.2.6.3 Provide valves with manufacturer's name or trade mark, figure number, and pressure rating, cast or stamped on valve body.
- 2.2.6.4 Globe and check valves shall be provided with manufacturer's recommended disc for type of service on which it is to be used, unless otherwise specified.
- 2.2.6.5 Provide iron or steel body valves with renewable seats.
- 2.3 **NPS 3" and Smaller**

### 2.3.1 Gate Valves

2.3.1.1 Class 125 bronze body, screwed ends, solid or split wedge disc, rising stem.

|              |          |
|--------------|----------|
| Crane        | Fig. 428 |
| Jenkins      | Fig. 810 |
| Kitz Fig. 24 |          |

### 2.3.2 Globe Valves

2.3.2.1 Class 150 bronze body, screwed ends, replaceable composition disc.

|               |           |
|---------------|-----------|
| Crane         | Fig. 7    |
| Jenkins       | Fig. 106B |
| Kitz Fig. 009 |           |

### 2.3.3 Ball Valves

2.3.3.1 Class 125 bronze body, screwed ends, teflon seats, Viton "O" rings, bronze ball, lever handle with plastic protector, and bottom, end or split access to ball.

|               |           |
|---------------|-----------|
| Crane "Capri" | Fig. 9302 |
| Jenkins       | Fig. 31   |
| Kitz Fig. 68  |           |

### 2.3.4 Check Valves

2.3.4.1 Class 150 bronze body screwed ends, lift check, screw-in cap, stainless steel disc, bronze seat ring.

|         |         |
|---------|---------|
| Jenkins | Fig. 54 |
|---------|---------|

## 2.4 NPS 4" and Larger

### 2.4.1 Gate Valves

2.4.1.1 Class 125 iron body, OS & Y bronze mounted, flanged ends.

|              |              |
|--------------|--------------|
| Crane        | Fig. 465-1/2 |
| Jenkins      | Fig. 454     |
| Kitz Fig. 72 |              |

### 2.4.2 Globe Valves

2.4.2.1 Class 125 iron body, bronze mounted, yoke bonnet, composition disc, renewable and regrindable bronze seat ring, flanged.

|               |          |
|---------------|----------|
| Crane         | Fig. 359 |
| Jenkins       | Fig. 142 |
| Kitz Fig. 351 |          |

### 2.4.3 Butterfly Valves

2.4.3.1 Class 150 full lug type cast iron body, bronze disc, 304 stainless steel shaft, EDPM seat, with notched top plate and lever lock handle for valves NPS 6" and smaller, and worm gear operator with handwheel for valves NPS 8" and larger. Lugs to be tapped.

|            |                      |
|------------|----------------------|
| Jenkins    | Fig. 2232            |
| Keystone   | Fig. FH12-CBJ-2      |
| Centerline | Fig. L200L-E/G200L-E |
| De Zurik   | Fig. BGS,L1/632      |

#### 2.4.4 Check Valves in Horizontal Lines

2.4.4.1 Class 125 horizontal swing check with iron body, bronze mounted, flat faced flanged ends, renewable and regrindable bronze seat ring and disc.

|              |          |
|--------------|----------|
| Crane        | Fig. 373 |
| Jenkins      | Fig. 587 |
| Kitz Fig. 78 |          |

#### 2.4.5 Check Valves in Vertical Lines

2.4.5.1 Class 125 wafer type non-slam check valve with cast iron body, bronze plates and Buna-N seals. Install between 2 flat faced flanges as specified for piping.

|               |              |
|---------------|--------------|
| Mission Valve | "Duo-Chek"   |
| Ritepro       | "Check Rite" |
| Agco          |              |
| Proquip       |              |

**PART 3 - EXECUTION****3.1 SUPPLY OF FLASHING ACCESSORIES FOR ROOF VENT STACKS**

- .1 Supply a vent stack cover accessory for each vent stack penetrating the roof.
- .2 Hand the vent stack cover to the roofing trade at the site for installation and flashing into roof construction as part of the roofing work.
- .3 Install vent stack piping up through and to a height as per vent stack cover manufacturer's instructions.

**3.2 DRAINAGE AND VENT PIPING INSTALLATION REQUIREMENTS**

- .1 Provide all required drainage and vent piping. Pipe, unless otherwise specified, shall be as follows:
  - .1 For underground pipe inside the building and to points 5' (1.5 m) outside building lines - Class 4000 cast iron, or rigid PVC sewer pipe, minimum 3" (75 mm) diameter; If PVC piping is used, provide type "BDS" or equal, piping for drainage piping up to 6" (150 mm) in diameter and type "Ultra-Rib" or equal, where drainage piping exceeds 6" (150 mm) diameter. PVC piping is specified in Section 15050;
  - .2 For pipe inside the building and above ground in sizes larger than 3" (75 mm) diameter - Class 4000 cast iron;
  - .3 For pipe inside the building and above ground in sizes to and including 3" (75 mm) diameter - type DWV copper;
  - .4 for drainage pump discharge pipe connections inside the building and above ground, from the pump to the gravity discharge main, including valve connections – Schedule 40 galvanized steel with grooved end galvanized couplings and fittings;
  - .5 for drainage pumped discharge piping underground inside and/or outside the building, to gravity main – rigid PVC pressure pipe and fittings.
- .2 At your option, drain, waste and vent piping (except acid-proof), 2 1/2" (65 mm) diameter to and including 6" (150 mm) diameter inside the building and above ground may be type "DWV" grooved end copper pipe, fittings and joints in lieu of solder joined copper piping.
- .3 Slope horizontal branches of vent piping down towards the fixture or pipe to which they connect with a minimum pitch of 2%.

- .4 Provide cleanouts in drainage piping in locations as follows:
  - .1 In the building drain or drains as close as possible to the inner face of the outside wall, and, if and where a building trap is installed, locate the cleanout on the downstream side of the building trap;
  - .2 At or as close as practicable to the foot of each drainage stack;
  - .3 At maximum 50' (15 m) intervals in horizontal pipe 4" (100 mm) diameter and smaller;
  - .4 At maximum 100' (30 m) intervals in horizontal pipe larger than 4" (100 mm) diameter;
  - .5 Wherever else shown on the drawings.
- .5 Cleanouts shall be the same diameter as the pipe in piping to and including 4" (100 mm) diameter, and not less than 4" (100 mm) in piping larger than 4" (100 mm) diameter.
- .6 Cleanouts in vertical piping shall be cleanout tees, cast iron in piping 3" (75 mm) diameter and larger, copper or bronze in piping smaller than 3" (75 mm).
- .7 Cleanouts in horizontal piping shall consist of TY fittings.
- .8 Cleanouts in horizontal inaccessible piping such as underground piping shall consist of TY fittings extended up to cleanout terminations set flush with the finished floor.
- .9 In waterproof areas, equip each termination with a flashing clamp device.
- .10 Where cleanout terminations occur in finished areas, locate the terminations to the Consultant's direction and arrange piping to suit.
- .11 Where cleanouts are concealed behind walls or partitions, install the cleanouts such that the cover is within 1" (25 mm) of the finished face of the wall or partition.
- .12 At your option, underground pipe inside the building and to points 5' (1.5 m) outside building lines rigid PVC or ABS and shall follow building code and local authority requirements;
- .13 At your option, pipe inside the building and above ground XRF and shall follow building code and local authority requirements.

### **3.3 INSTALLATION OF DRAINS**

- .1 Provide drains where shown on the drawings.
- .2 In Equipment Rooms and similar areas, exactly locate floor drains to suit the layout of mechanical equipment and location of equipment indirect drainage piping.
- .3 In finished areas, confirm the exact location and finish of drains with the Consultant prior to roughing-in.
- .4 Equip each drain connected to sanitary drainage piping with a trap.
- .5 Provide vent piping and cold water supply piping to drains wherever required by Part 7 (Plumbing) of the Ontario Building Code and/or shown on the drawings. Water supply piping from trap seal priming unit to drains shall consist of Type "M" hard copper tubing above ground and Type "L" soft copper underground.
- .6 Place roof drains in position for flashing into roof construction as part of the roofing work. When mounting is complete, connect with piping and provide drain accessories.

### **3.4 DOMESTIC WATER PIPING INSTALLATION REQUIREMENTS**

- .1 Provide all required domestic water piping in accordance with the requirements of Part 7 (Plumbing) of the OBC. Pipe, unless otherwise noted shall be as follows:

- .1 For underground service piping to inside building - cement lined centrifugal ductile iron or where approved by governing authorities, Canron "Blue Brute" rigid PVC;
- .2 For service pipe inside the building and above ground from termination of underground main to and including meter connection and bypass and similar service entrance connections - type "K" hard drawn copper.
- .3 For all domestic hot water, cold water and tempered water distribution piping inside the building and above ground except as noted above - type "L" hard copper.
- .2 At your option, domestic hot, cold and tempered water distribution piping 2 1/2" (65 mm) diameter to and including 6" (150 mm) diameter inside the building and above ground except as noted above may be type "L" grooved end copper pipe, fittings and joints in lieu of solder joined copper piping.
- .3 At your option, domestic hot, cold and tempered water distribution piping 1/2" (12 mm) diameter to and including 4" (100 mm) diameter inside the building and above ground except as noted above may be Viega type "L" "ProPress" copper pipe, fittings and joints in lieu of solder joined copper piping.
- .4 Brace and secure underground water service pipe at bends and tees with concrete thrust blocks in accordance with Municipal Standards.
- .5 Slope all piping so that it can be completely drained.
- .6 Provide an accessible manually operated air vent above the high point of each water piping system unless the systems are suitably vented through frequently used plumbing fixtures or outlets.
- .7 Provide a vacuum breaker in piping connecting a hose bibb provided integral with the hose bibb or similar fitting. Install in accordance with CAN/CSA-B64.10-94.
- .8 Provide water hammer arrestors in piping in accordance with P.D.I. Standard P.D.I.- WH201, and where shown on the drawings and in accordance with drawing equipment connection schedules.
- .9 Provide recirculating balancing valves in piping generally where shown on the drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation. Ensure that balancing valves are a minimum of ten (10) pipe diameters downstream of any pump or fitting and a minimum of five (5) pipe diameters upstream of any fitting. Hand over insulation accessories to insulation trade, on site, for installation into pipe insulation.
- .10 Provide a backflow preventer assembly in make-up water piping to mechanical plant circulating systems and equipment. Provide an air gap secured to backflow preventer, and connect with drain piping terminated over nearest funnelled floor drain. Install complete assembly in accordance with manufacturers instructions and the requirements of CSA Standard CAN/CSA-B64.10-94. Test each back flow assembly in accordance with the requirements of CSA Standard CAN/CSA-B64.10-94.
- .11 Provide shut-off valves to isolate all equipment and wherever else shown.

### **3.5 INSTALLATION OF ELECTRONIC TRAP PRIMING UNITS**

- .1 Provide trap priming units where shown on the drawings and mount at an elevation suitable to provide flow to floor drain traps.

### **3.6 INSTALLATION OF HOSE BIBBS**

- .1 Provide hose bibbs where shown on the drawings.
- .2 Provide a shut-off valve inside the building in piping to each exterior wall mounted hose bibb.
- .3 Confirm the exact location of hose bibbs in finished areas and all exterior wall mounted hose bibbs with the Consultant prior to roughing-in.
- .4 Supply two (2) identified loose key operators for exterior hose bibbs and hand the operators over to the Consultant at the site prior to application for a Certificate of Substantial Performance of the Work.

### **3.7 INSTALLATION OF WATER METER**

- .1 Provide water meter(s) where shown on the drawings. Secure the meter on a 6" (152 mm) concrete housekeeping pad and connect with piping as indicated, including a three (3) valve bypass, with strainer on street side and drain-out valve on building side to accommodate meter.
- .2 Meter shall be suitable for future installation of remote reader to be installed in location to approval of Jurisdictional Authorities. Provide conduit for future wiring from meter to remote reader.

### **3.8 INSTALLATION OF DOMESTIC WATER PRESSURE REDUCING VALVES**

- .1 Provide domestic water pressure reducing valves as follows:
  - .1 In domestic cold water make-up piping to the boiler water circulating system expansion tank;
  - .2 In domestic cold water make-up piping to the glycol heating circulating system expansion tank;
  - .3 Wherever else shown or specified.
- .2 Install each valve in accordance with the manufacturer's recommendations, check and test operation, and adjust as required.

### **3.9 FLUSHING AND DISINFECTION OF DOMESTIC WATER PIPING**

- .1 Flush domestic water piping with a sufficient flow to produce a velocity of 5' (1.5 m) per second for ten (10) minutes, or until all foreign materials have been removed and the flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose bibbs and service connections to ensure thorough flushing.
- .2 When flushing is complete, disinfect the piping with a solution of chlorine in accordance with AWWA C601-68. The rate of chlorine application shall be proportional to the rate of water entering the pipe. The point of chlorine application shall be close to the point of filling the piping and shall occur at the same time. Operate valves, faucets and similar appurtenances while the piping contains chlorine solution.
- .3 Flush piping of chlorine solution after twenty-four (24) hours.
- .4 Measure chlorine residuals at the extreme end of each piping system being disinfected. After a chlorine residual of not less than 50 ppm has been obtained, leave the system for twenty-four (24) hours. Take further samples to ensure that there is still not less than 10 ppm of chlorine residual throughout the system.
- .5 When disinfecting is complete, fill the systems.

### **3.10 INSTALLATION OF SUMP PUMPS**

- .1 Provide a submersible sump pump on a concrete base in the sump pit.
- .2 Provide all required sump pit piping, including a shut-off valve and a check valve for the pump.
- .3 Provide rigid PVC conduit from the sump pit to the wall on which the pump receptacle and starter are located. Pull the pump power cord with integral plug through the conduit and plug into the receptacle. Seal conduit air-tight around the cord at both conduit termination points. Do not remove the plug from the power cord.
- .4 Provide sump pit accessories.
- .5 Ensure that the pump power cord is of sufficient length to extend unbroken to the receptacle. Confirm length requirements prior to ordering.

### **3.11 INSTALLATION OF DRAINAGE PIT FRAMES AND COVERPLATES**

- .1 Provide a frame and coverplate for each drainage pit.

- .2 Co-ordinate frame installations with the trade forming and pouring the pits. Either supply the frames and arrange to have them formed in with the pits, or provide the frames after the pits have been poured and grout the frames in place using non-shrink grout.
- .3 Bolt coverplates to frames. Provide gaskets between frames and coverplates for sanitary drainage pits.
- .4 Paint the frame and coverplate to match the surrounding floor. Ensure that frame can be removed or opened after painting has been completed.

### 3.12 PLUMBING PIPING CONNECTIONS FOR EQUIPMENT AND SYSTEMS

- .1 Rough-in all required plumbing piping connections to equipment and systems. Confirm exact locations of equipment prior to roughing-in. When equipment or systems are installed, connect from the roughed-in work unless otherwise specified.
- .2 Mechanical equipment connections requirements include the following (where RP and DCAP respectively denote reduced pressure principle type and dual check valve with atmospheric port type backflow preventers):
  - .1 Drainage piping connections with deep seal traps to fan system equipment drain pans;
  - .2 Valved domestic cold water piping connection with RP Type backflow preventer and pressure reducing valve to heating water circulating system expansion tank make-up piping;
  - .3 Valved domestic cold water piping connection with vacuum breaker and hose connection for glycol solution make-up.

### 3.13 VIDEO INSPECTION OF DRAINAGE PIPING

- .1 Immediately after compaction of backfill and again immediately prior to applying for substantial completion, inspect all buried storm and sanitary drainage piping by means of special video camera.
- .2 Provide a video CD or DVD of each inspection clearly identified as to the nature of the inspection, date of inspection, personnel performing inspection and sequentially indicate exact location of camera at appropriate intervals during the inspection, referenced to drawings. Review proposed inspection procedure with Consultant. Comply with Consultant's directives.
- .3 Submit video CDs or DVDs of inspections to the consultant for review promptly after each inspection.
- .4 Be responsible for all costs associated with remedial work required for disturbing installed work, over and above remedial work required to correct defective/obstructed piping.

**END OF SECTION 15400**



## **SECTION 15450 - PLUMBING FIXTURES AND FITTINGS**

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## **SECTION 15450 - PLUMBING FIXTURES AND FITTINGS**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 Section 15010 applies to and is an integral part of this Section of the Specification.
- .2 Section 15050 in this Division of the Specification also applies to and is a part of this Specification. The Section contains requirements, products and methods of execution that apply to this Section as well as to other Sections of Division 15.

#### **1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 The following work which is related to the plumbing fixture and fitting work is specified in other Sections of the Specification:
  - .1 Provision of counters and cutting or drilling counters to accept plumbing fixtures and trim;
  - .2 Provision of washroom accessories including soap dispensers and grab bars;
  - .3 Provision of sealant for fixtures;
  - .4 Provision of power wiring, back boxes for "No-Touch" fixture trim.

#### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings (fixture cuts) for all plumbing fixtures and fittings.

### **PART 2 - PRODUCTS**

#### **2.1 REFER TO DRAWINGS FOR PRODUCT SCHEDULE**

#### **2.2 ACCEPTABLE PLUMBING FIXTURE AND FITTING MANUFACTURERS**

- .1 Acceptable manufacturers of plumbing fixtures and fittings are as follows:
  - .1 Vitreous china, enamelled steel and enamelled cast iron fixtures, unless otherwise noted American Standard, Zurn, and Crane;
  - .2 Stainless steel sinks – Kindred Commercial Ltd., and Architectural Metal Products
  - .3 Water closet seats - Centoco, Moldex, Olsonite, and Beneke;
  - .4 Flush valves – Sloan, Delta Commercial, Zurn;
  - .5 Fixture carriers - J. R. Smith, Watts Industries and Zurn Industries;
  - .6 Supply fittings, unless otherwise noted - Chicago Faucets, Delta Commercial, Zurn Industries, Sloan, Speakman and American Standard;
  - .7 Drain fittings, angle supplies and traps unless otherwise noted McGuire, Zurn Industries, Delta Commercial, Chicago Faucets and American Standard;
  - .8 Prefabricated mop sinks - Stern Williams and Fiat;
  - .9 Emergency eye washes - Haws, Guardian, Bradley, and Speakman;
  - .10 Mechanical and thermostatic mixing valves – Haws, Symmons, Powers, Leonard and RADA.

## SECTION 15450 - PLUMBING FIXTURES AND FITTINGS

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS

- .1 Provide plumbing fixtures and fittings where shown on the drawings.
- .2 Connect plumbing fixtures and fittings with piping of minimum size in accordance with the following schedule. Refer to manufacturer's published connection (rough in) requirements. Where manufacturer requires piping connection larger than shown below, provide piping accordingly:

| FIXTURE AND/OR FITTING         | DRAIN<br>SIZE IN.<br>(mm) | VENT<br>SIZE IN.<br>(mm) | DHW<br>SIZE IN.<br>(mm) | DCW<br>SIZE<br>IN.(mm) | TEMP<br>WATER<br>SIZE IN.<br>(mm) |
|--------------------------------|---------------------------|--------------------------|-------------------------|------------------------|-----------------------------------|
| Water Closets Flush Valve Type | 4 (100)                   | 1 1/2 (38)               |                         | 1 (25)                 |                                   |
| Urinals                        | 2 (50)                    | 1 1/2 (38)               |                         | 3/4 (20)               |                                   |
| Lavatories                     | 1 1/4 (32)                | 1 1/4 (32)               | 1/2 (12)                | 1/2 (12)               |                                   |
| Counter Sinks                  | 1 1/2 (38)                | 1 1/4 (32)               | 1/2 (12)                | 1/2 (12)               |                                   |
| Prefab. Mop Sinks With Drain   | 3 (75)                    | 1 1/2 (38)               | 3/4 (20)                | 3/4 (20)               |                                   |
| Emergency Eye Wash             |                           |                          |                         |                        | 1/2 (12)                          |
|                                |                           |                          |                         |                        |                                   |

- .3 Confirm the exact location of all plumbing fixtures and trim prior to roughing in. Refer to architectural drawing part plans and elevations as applicable.
- .4 Unless otherwise noted, all vitreous china and enamelled fixtures shall be white.
- .5 Unless otherwise noted, all exposed piping associated with fixtures shall be polished and chrome plated.
- .6 Provide properly sized water hammer arrestors in hot and cold rough in piping at individual or groups of plumbing fixtures. Water hammer arrestors are specified in Section 15400. Install water hammer arrestors in strict accordance with the manufacturer's instructions, and ensure that water hammer arrestors are accessible.
- .7 When installation is complete, check and tests the operation of each fixture and fitting. Adjust or repair as required.
- .8 Supply templates for all counters mounted plumbing fixtures and fittings and turn the templates over to the trade(s) cutting the counter openings.
- .9 Prior to ordering or installation, confirm that carriers specified for wall hung fixtures are suitable in all respects for the fixtures and the wall construction and finish.
- .10 Adjust the fixture carrier for wall hung wheelchair lavatories so that the top of the bowl is 33" (838 mm) above the finished floor.
- .11 Where a mixing valve is specified (i.e., lavatory or sink), pipe outlet of valve to supply fitting hot water inlet, unless shown or specified otherwise.

**END OF SECTION**

## **SECTION 15500 – FIRE PROTECTION**

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## SECTION 15500 – FIRE PROTECTION

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### PART 1 - GENERAL

#### 1.1 REFERENCES

- .1 Section 15010 in this Division of the Specification applies to and is a part of this Section.
- .2 Section 15050 in this Division of the Specification also applies to and is a part of this Section of the Specification. The Section contains requirements, products and methods of execution that apply to this Section as well as to other Sections of Division 15.

#### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 The following work which is related to the sprinkler work is specified in other Sections of the Specification:
  - .1 Fire alarm system wiring connections to sprinkler equipment;
  - .2 Provision of electric power wiring connections to equipment and controls.
  - .3 Provision of domestic water service piping.

#### 1.3 SHOP DRAWINGS

- .1 Submit shop drawings for the following:
  - .1 Complete and dimensioned system layout drawings indicating all heads and equipment, pipe sizing, all calculations and design data used in preparing the layouts and sizing the piping.
- .2 Note that the layout drawings must first be submitted to and approved by the local governing authorities prior to being submitted to the Consultant for review.

#### 1.4 CONTRACTOR'S REQUIREMENTS

- .1 Contractor providing work of this Section shall be a Member in Good Standing of the Canadian Automatic Sprinkler Association.
- .2 Contractor's personnel installing sprinkler work shall possess a valid Certificate of Qualification issued by the Ontario Ministry of Labour.
- .3 The above requirements shall supplement other requirements stipulated or implied elsewhere in the Specification.

### PART 2 - PRODUCTS

#### 2.1 SPRINKLER PIPING HANGERS AND SUPPORTS

- .1 Generally, as specified in PART 2 of Section 15050, but ULC listed.

#### 2.2 SHUT-OFF AND CHECK VALVES

- .1 Gate type OS&Y shut-off valves or lug body butterfly type shut-off valves, and horizontal swing check valves or lug body wafer type check valves, generally as specified in Section 15050, but minimum 175 psi (1207 kPa) rated and ULC listed and F.M. approved.
- .2 For grooved end mechanical coupling joint piping, Victaulic Series 705W and Tyco Fire and Building Products Model BFV-N, ULC, listed and F.M. approved butterfly valves with gear operators, Series 728 "Fire Ball" ULC listed and F.M. approved ball valves, and Series 717 "Fire Lock Check Valves" ULC listed and F.M. approved dual disc check valves are acceptable.
- .3 Check valves associated with siamese connection(s) shall be tapped for site installation of a 19 mm (3/4") diameter automatic ball drip.

### 2.3 PIPING SHUT-OFF VALVE SUPERVISORY SWITCHES

- .1 Potter Electric Signal & Mfg. Ltd., or Conswiss Industries Ltd., "VALVE GUARD," ULC listed and F.M. approved, 115 volt, tamper-proof valve supervisory switches, each arranged to initiate an alarm condition if the valve is closed or the switch is removed or tampered with, and each complete with all required mounting and connection hardware.
- .2 Where Victaulic shut-off valves are used, Victaulic Style 737 ULC listed supervisory switches are acceptable.

### 2.4 PIPING "LOSS OF PRESSURE" ALARM SENSORS

- .1 ULC listed 115 volt or 24 volt (to suit fire alarm system), adjustable, piping mounted pressure sensor with contacts arranged to actuate a fire alarm system trouble signal if piping pressure drops to a pressure below the switch setting.

### 2.5 WATER FLOW ALARM SWITCHES

- .1 Potter Electric Signal & Mfg. Ltd. Model VSR, ULC listed and F.M. approved, pipe mounting water flow switches, each complete with a vane type sensor operating two (2) single pole double throw snap-action switches when sustained water flow exceeds 10 GPM (0.75 l/s), integral field adjustable pneumatic retard device with automatic reset to delay switch operation to reduce the possibility of false alarms caused by a single or series of transient water flow surges, tamper proof cover, U-bolt, and piping saddle.
- .2 Where grooved end mechanical coupling joint piping is used, Victaulic Style 736 ULC listed and F.M. approved water flow alarm switches are acceptable.

### 2.6 ALARM CHECK VALVES

- .1 Tyco Fire and Building Products Model No. AV-1-300 grooved end, external by-pass, divided seat ring, ULC listed, F.M. approved, 300 psi (2609 kPa) rated alarm check valves sized as indicated on the Drawings, each complete with supply and system pressure gauges with valved connections, valved main drain connection, alarm actuation pressure switch, alarm test by-pass, and standard vertical or horizontal alarm trimmings.

### 2.7 SPRINKLER ZONE INSPECTOR'S TEST CONNECTION ASSEMBLIES

- .1 Victaulic Co. of Canada, Style 720, ULC listed and F.M. approved, "Test Master II", factory assembled inspector's test connection assemblies, each complete with a ductile iron body, a combination orifice/sight glass with orifice sized to suit the number of zone sprinkler heads, a plugged tapping for installation of a pressure gauge, and valves to permit testing zone water flow and zone drainage without shutting down the entire sprinkler riser or system.

### 2.8 BALL DRIP

- .1 National Fire Equipment Ltd., Model No. 235 or equal, 19 mm (3/4") diameter automatic ball drip to drain the piping between a siamese connection and the associated check valve.

### 2.9 EXCESS PRESSURE PUMP AND CONTROL PANEL

- .1 Albany Pump Company Limited gear type bronze pump with the performance characteristics as specified below, close-coupled to a motor and complete with a stainless steel shaft, lifetime lubricated bearings, and an installation accessory package including flexible hose suction and discharge connections, inlet strainer, pressure relief valve and flange mounting brackets.
- .2 The control panel shall be a surface wall mounting pre-wired panel with an EEMAC 2 enclosure, a pump starter, HOA selector switch, control transformer, a set of normally open and normally closed dry contacts for remote indication of power availability and pump operation, and a CSA certified and ULC listed 115 volt adjustable pressure controller suitable in all respects for the application.
- .3 Pump performance characteristics shall be as follows:
  - .1 Manufacturer and Model No.: Albany Model CEP-86-5;

## SECTION 15500 – FIRE PROTECTION

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- .2 Flow rate: 3.5 USGPM (13.2 L/m);
  - .3 Differential Pressure: 100 psi ;
  - .4 Motor Horsepower: 1/2 (HP (0.373 kW);
  - .5 Electrical Characteristics 230 volt / 3-phase / 60 hertz.
- .4 Acceptable pump manufacturers are Albany Pump Co. Ltd., S.A. Armstrong Ltd., and Viking Pump of Canada Ltd.

### 2.10 SPRINKLER HEADS

- .1 ULC listed sprinkler heads as follows:
- .1 Equal to Tyco Fire and Building Products Model “TY-FRB”, upright, pendant type and sidewall type.
  - .2 Equal to Tyco Fire and Building Products Model “DS-1,” dry sidewall or pendant type sidewall heads.
  - .3 Equal to Tyco Fire and Building Products Model “RFII - Royal Flush II,” pendant concealed, with white plated cover;
  - .4 Equal to Tyco Fire and Building Products Model “WS” specific application window sprinklers, vertical sidewall and/or horizontal sidewall type.
- .2 Sprinkler heads in finished areas shall be white unless otherwise noted.
- .3 Sprinkler heads which are in exposed areas where they may be subject to damage shall be complete with wire guards, chrome-plated where in finished areas.
- .4 Sprinkler heads located in areas or over equipment where high ambient temperature is present shall be proper high temperature heads. All other heads shall be 74°C (165°F) unless otherwise noted.
- .5

### 2.11 SPARE SPRINKLER HEAD CABINET

- .1 Surface wall mounting No. 22 gauge red enamelled steel identified cabinet with hinged door, shelves with holes for mounting twelve (12) sprinkler heads, a wrench or wrenches suitable for each type of sprinkler head and a full complement of spare sprinkler heads with the quantity equally divided by the different types of heads used.

### 2.12 WATER MOTOR ALARM

- .1 Grinnell Fire Protection Co. Inc., Model No. B-3, ULC listed and F.M. approved, wall mounting water motor alarm with 19 mm (3/4") diameter inlet piping and Model No. WM-1 strainer, 32 mm (1-1/4") diameter galvanized steel drainage piping with fittings and wall plate, a “SPRINKLER FIRE ALARM - WHEN ALARM SOUNDS, CALL FIRE DEPARTMENT” identification sign for securing on the exterior wall at the gong location, and all required trim and accessories.

### 2.13 ACCEPTABLE SPRINKLER COMPONENT MANUFACTURERS

- .1 Except where acceptable manufacturers are named for products, equipment, etc., products may be supplied by one (1) of the following manufacturers: Tyco Fire and Building Products, Grinnell Corporation, Star Sprinkler Corporation, Reliable (Vipond Automatic Sprinkler), Central Sprinkler Company (not including the OMEGA line of products), The Viking Corporation or Victaulic Co. of Canada.
- .2 Products, equipment, etc., supplied must, as a minimum, have approvals specified plus any other approvals required by the Authority.

## SECTION 15500 – FIRE PROTECTION

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### 2.14 FIRE EXTINGUISHERS

- .1 National Fire Equipment Ltd., Diamond Fire Extinguisher, Model ABC-05WWD, 10 lb. (2.3 Kg.), ULC listed and 3A:10BC rated pressurized dry chemical extinguishers, each complete with a wall mounting bracket and securing hardware.
- .2 Acceptable manufacturers are National Fire Equipment Ltd., C.F.H. Industries Ltd., Pyrene Corp. and Wilson & Cousins.

### 2.15 FIRE EXTINGUISHER CABINETS

- .1 National Fire Equipment Ltd., Model 102RS, fully recessed 200 mm x 430 mm x 127 mm (8" x 17" x 5") deep prime coat painted steel cabinets, each with a white enamel interior finish, a full length of piano hinge, door catch, and "Duo-lite" safety glass panel.
- .2 Acceptable manufacturers are National Fire Equipment Ltd., C.F.H. Industries Ltd. and Wilson & Cousins.

### 2.16 FIRE PROTECTION MAIN DOUBLE CHECK VALVE ASSEMBLY

- .1 Watts Industries (Canada) Inc., Model 757OSY, two independent tri-link check modules within a single housing, sleeve access port, four test cocks and two drip tight shut-off valves. Tri-link valves shall be removable and serviceable. The housing shall be constructed of 304 schedule 40 stainless steel pipe with OSY resilient seated gate valves, all tested and certified to the latest revisions of CAN/CSA B64.5 and AWWA C510.
- .2 Acceptable manufacturers are Watts Industries (Canada) Inc., Hersey Products Inc. and Zurn "Wilkins Division".

### 2.17 FIRE DEPARTMENT SYSTEM CONNECTION

- .1 National Fire Equipment Ltd., Model 229, flush wall mounting siamese connection with two (2) 65 mm (2-1/2") diameter inlets threaded to Fire Department hose requirements and equipped with caps and chains, 150 mm (6") diameter outlet, and a brass faceplate with "SPRINKLER" and "FIRE DEPT. CONNECTION" cast in raised lettering.
- .2 Exposed metal parts of the siamese shall be chrome plated and highly polished.
- .3 Acceptable manufacturers are National Fire Equipment Ltd., C.F.H. Industries Ltd., Wilson and Cousins and Impact Fire Equipment Inc.,

## PART 3 - EXECUTION

### 3.1 SPRINKLER SYSTEM PIPING INSTALLATION REQUIREMENTS

- .1 Provide all required sprinkler system piping.
- .2 Underground service pipe to inside the building shall be centrifugally cast ductile iron or where approved by the Authority, rigid FM approved PVC pressure pipe braced and secured at bends and tees with concrete thrust blocks in accordance with Municipal standards and details.
- .3 Unless otherwise noted, pipe inside the building and above ground shall be Schedule 40 mild black steel, screwed for pipe to 65 mm (2-1/2") diameter, screwed or welded for pipe 65 mm (2-1/2") diameter and larger. Where permitted by NFPA No. 13, pipe may be Schedule 30 and "Thinwall" mild black steel with welding fittings and joints, all in accordance with NFPA No. 13 requirements.
- .4 At your option, pipe inside the building and above ground may be factory or site grooved end black steel pipe with Victaulic fittings and couplings in accordance with the requirements of Section 15050. Where working pressure will not exceed 1200 kPa (175 psi), couplings and fittings may be Victaulic "FIRELOCK." Victaulic "FIT" fast installation tees will be acceptable for sprinkler head tees only.
- .5 Sprinkler piping in shower areas shall be type "M" hand copper with 95% tin – 5% antimony solder joints.



## SECTION 15500 – FIRE PROTECTION

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- .6 Sprinkler work shall be hydraulically sized by a Professional Engineer, based on the procedures of NFPA No. 13. Be responsible for obtaining all required water flow test and pressure data. Submit flow test data and calculations used, with the shop drawings. Calculations used for hydraulically sized systems shall bear the Professional Engineer's signed stamp.
- .7 Provide a double check valve assembly in the sprinkler water main inside the building where shown.
- .8 Provide shut-off valves and check valves in sprinkler piping where shown.
- .9 Where shown, equip shut-off valves with supervisory switches.
- .10 Slope all horizontal piping so that it may be drained completely through risers, equipment or through valved drainage branches.
- .11 Provide sprinkler piping flushing connections consisting of threaded and capped 100 mm (4") long nipples on the ends of mains where required and/or shown.
- .12 Provide inspector's test connections where required by Code and as shown. Provide all required test connection drainage piping.
- .13 Generally, arrange and install sprinkler work as shown on the drawings, however, exact arrangement and installation must comply with all requirements of the latest edition of "INSTALLATION OF SPRINKLER SYSTEMS." NFPA No. 13, the Standard of the National Fire Protection Association and as adopted by the Fire Department.
- .14 Municipal Water Supply Testing:
  - .1 Arrange for any testing necessary to confirm adequacy of municipal water supplies.
  - .2 Contractor shall be responsible for all work, permits and fees associated with the testing.
- .15 At your option, piping 2" (50 mm) diameter and smaller, may be Victaulic "Pressfit" mechanically bonded black steel in accordance with the requirements of Section 15050.

### **3.2 INSTALLATION OF PIPING "LOSS OF PRESSURE" SENSORS**

- .1 Provide pressure sensors in piping where shown to activate fire alarm system "LOSS OF PRESSURE" trouble alarm circuitry. Adjust pressure sensor settings to suit site piping pressure conditions and test operation.

### **3.3 INSTALLATION OF ALARM CHECK VALVE(S)**

- .1 Provide alarm check valve(s) in wet zone sprinkler piping where shown. Install in accordance with the manufacturer's recommendations and instructions and connect with piping as indicated.
- .2 Check and test operation of valve(s) and adjust as required to suit site water pressure conditions.

### **3.4 INSTALLATION OF FLOW ALARM SWITCH(ES)**

- .1 Provide water flow alarm switch(es) in wet sprinkler zone piping where shown. Install in accordance with the manufacturer's recommendations and instructions and connect with piping as indicated.
- .2 Adjust to suit site water pressure conditions. Check and test operation.
- .3 Where shown on the drawings, install flow alarm switches and inspector's test connection assemblies in flush wall mounted identified boxes. Confirm box locations prior to roughing-in.

### **3.5 INSTALLATION OF SPRINKLER SYSTEM EXCESS PRESSURE PUMP AND CONTROL**

- .1 Provide an excess pressure pump in sprinkler system piping where shown, arranged to prevent activation of flow alarms during normal water pressure fluctuations in the main. Provide a pressure gauge in valved tubing across pump suction and discharge connections.

## SECTION 15500 – FIRE PROTECTION

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- .2 Supply a starter and control panel for the pump and surface wall mount adjacent the pump where shown. Connect the panel pressure switch with tubing in accordance with the pump manufacturer's recommendations. Adjust the pressure switch to suit site conditions.
- .3 Connect the starter and control panel pressure switch with tubing extended from system piping. Confirm the point of connection to system piping prior to roughing-in. Adjust the pressure switch to suit site conditions.
- .4 Test pump operation and adjust as required.

### 3.6 INSTALLATION OF SPRINKLER HEADS

- .1 Provide all required sprinkler heads.
- .2 Unless otherwise noted, sprinkler heads shall be as follows:
  - .1 in equipment rooms and rooms in unfinished areas without a finished ceiling – brass pendant or upright heads;
  - .2 in finished areas without a suspended ceiling – chrome plated pendant or upright heads;
  - .3 in elevator shafts – sidewall type;
  - .4 Semi recessed and spray type sprinkler heads in white colour shall be provided in areas with finished ceilings.
  - .5 Dry pendant type sprinkler heads shall be provided in all secondary entrance vestibules, garbage room and outdoor storage rooms.
- .3 The Contractor must mock-up mounting of sprinkler head for review by the Consultant and Board.
- .4 Ensure that the maximum protrusion of semi-recessed sprinkler heads from the underside of the finished ceiling shall be 25 mm (1"). Failure to comply with this requirement shall result in reinstallation of sprinkler heads.
- .5 Maintain maximum headroom in areas with no ceilings.
- .6 Provide guards for heads in gymnasium, storage rooms, and wherever else indicated on drawings where they are subject to damage.
- .7 Provide high temperature heads where required.
- .8 Coordinate sprinkler head locations in areas with suspended ceilings with the location of lighting, grilles, diffusers, and similar items recessed in or surface mounted on the ceiling as per the reflected ceiling plans. In areas with lay-in tile, centre the sprinkler head both ways in the lay-in tile.
- .9 Supply a full complement (to fill cabinet) of spare sprinkler heads of the types used and place in a wall mounting storage cabinet located in a Mechanical Room where later directed. Provide the cabinet, complete with lock and key and sprinkler head wrench for each type of head.
- .10 Easyflex sprinkler drops or approved equal corrugated flexible fire sprinkler drops complete with T bar brackets, snap clamps, stock bars, etc. to ULC listed, FM approved and NFPA standards are acceptable.

### 3.7 INSTALLATION OF WATER MOTOR ALARM

- .1 Provide a water motor alarm at the exterior wall where shown. Secure the gong on the exterior wall, the impeller and motor assembly on the interior wall, and connect with the drive assembly in accordance with the manufacturer's recommendations and instructions. Install the inlet strainer supplied loose with the assembly.
- .2 Provide a galvanized steel drain pipe from the impeller-motor assembly down the interior wall and terminate the piping through the wall with a piping elbow and wall plate 600 mm (24") above finished grade.

## **SECTION 15500 – FIRE PROTECTION**

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.3 Confirm exact location of the alarm gong prior to roughing-in.

.4 When installation is complete, check and test alarm operation and adjust as required.

### **3.8 INSTALLATION OF FIRE EXTINGUISHERS**

.1 Provide fire extinguishers where shown. Unless otherwise noted, wall mount each extinguisher with a mounting bracket.

### **3.9 INSTALLATION OF FIRE EXTINGUISHER CABINETS**

.1 Provide wall mounted fire extinguisher cabinets where shown on the drawings. Equip each cabinet with an extinguisher.

### **3.10 INSTALLATION OF FIRE DEPARTMENT CONNECTION**

.1 Provide a fire department connection for the sprinkler system where shown and connect with piping as indicated.

.2 Provide an automatic ball drip to drain the piping between the check valve and the siamese connection and extend piping from the outlet of the ball drip to the nearest suitable drain.

**END OF SECTION 15500**

## **SECTION 15600 – POWER AND HEAT GENERATION**

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## **SECTION 15600 – POWER AND HEAT GENERATION**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 Section 15010 in this Division of the Specification applies to and is a part of this Section.
- .2 Section 15050 in this Division of the Specification also applies to and is a part of this Section of the Specification. The Section contains requirements, products and methods of execution that apply to this Section as well as other Sections of Division 15.

#### **1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS OR PROVIDED BY OWNER**

- .1 The following work which is related to the power and heat generation work is specified in other Sections of the Specification (or provided by Owner as noted):
  - .1 provision of power wiring connections to boilers and boiler plant control panel, and all required 115 volt control wiring;
  - .2 provision of flues and stacks for natural gas fired equipment;
  - .3 supply of boiler boil-out chemical and embrittlement inhibitor.

#### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings for all equipment and accessories specified in PART 2 of this Section.

### **PART 2 - PRODUCTS**

#### **2.1 GAS FIRED DOMESTIC HOT WATER STORAGE HEATER**

- .1 A.O. Smith Ltd., CGA approved, natural gas fired, factory tested domestic hot water storage heaters as per the drawing schedule, each complete with:
  - .1 A 160 psi rated high tensile glass lined steel tank equipped with a maintenance free powered anode, insulated with foam insulation, fitted with a hand hole type gasketed cleanout, and covered with a baked enamelled steel jacket;
  - .2 A stainless steel atmospheric burner with gas pressure regulator, CGA approved piping train, 100% safety shut-off controls in event of pilot failure, and adjustable thermostat;
  - .3 The control shall be an integrated solid state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display and shall have digital temperature readout.;
  - .4 A temperature and pressure relief valve, to ANSI 21.22 and/or CGA CAN-4.4;
  - .5 A factory fabricated inlet and outlet piping manifold assemblies constructed of type "L" hard copper tubing and arranged to suit the number of heaters in the assembly;
  - .6 A drain valve;
  - .7 Concentric vent kit – BTH-120-300 vent kit p/n 9006328005 for each tank.
  - .8 Refer to drawings for Equipment Schedule.
- .2 Acceptable manufacturers are Bock Water Heaters, A.O. Smith Enterprises Ltd , Rheem Canada Inc., and Bradford White.

### **PART 3 - EXECUTION**

#### **3.1 GAS PRESSURE**

- .1 Establish the pressure of the gas at all gas fired appliances prior to ordering the equipment.

#### **3.2 INSTALLATION OF GAS FIRED DOMESTIC HOT WATER STORAGE HEATERS**

## **SECTION 15600 – POWER AND HEAT GENERATION**

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- .1 Provide gas fired domestic hot water storage heaters where shown.
- .2 Secure each storage heater in place, level and plumb, on a concrete housekeeping pad and connect with gas piping.
- .3 Supply prefabricated water inlet and outlet piping manifold assemblies with the storage heaters and hand the manifolds to the trade doing the plumbing work for installation. Refer to the drawing detail.
- .4 Provide power vent and intake on each storage heater and extend and connect vent terminal to vent terminals. Provide all required power wiring for vent fan.
- .5 When installation is complete, check and test heater operation and all safeties and control. Adjust as required and, unless otherwise specified, set the thermostats so the heaters produce 120 degrees F. (49 degree C.) hot water.

### **3.3 NATURAL GAS SYSTEM PIPING INSTALLATION REQUIREMENTS**

- .1 Make all required arrangements with the natural gas supply Utility on behalf of the Owner for installation gas service piping with gas pressure regulator and meter assembly where shown.
- .2 Provide all required natural gas distribution piping to connect gas fired or operated equipment, and provide all required vent piping to atmosphere. Do all piping work in accordance with requirements of CAN1-B149.1-00 as amended by the Ontario Gas Utilization Code and requirements of any other Governing Authority.
- .3 Pipe shall be Schedule 40 mild black steel.
- .4 Provide CGA approved ball type or lubricated plug type shut-off valves to isolate equipment, and wherever else shown.
- .5 Slope gas piping in the direction of flow to low points.
- .6 Provide full pipe diameter, 6" (150 mm) long drip pockets at the bottom of all vertical risers, at all piping low points, and wherever else shown and/or required.
- .7 Identify all natural gas piping in accordance with requirements of Governing Authorities.
- .8 Ensure that Gas Utility and the TSSA has inspected each piece of gas fired equipment and that it has been approved for operation (i.e.: Gas Utility has affixed a tag to each piece of gas fired equipment).
- .9 After all gas fired equipment is hooked up, arrange for a final inspection by the Natural Gas Utility company and the TSSA.

**END OF SECTION 15600**

## **SECTION 15850 – AIR HANDLING**

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- 3.8 INSTALLATION OF AIR FILTERS
- 3.9 INSTALLATION OF AIR FILTER GAUGES

## SECTION 15850 – AIR HANDLING

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### PART 1 - GENERAL

#### 1.1 REFERENCES

- .1 Section 15010 in Division 15 applies to and is a part of this Section of the Specification.
- .2 Section 15050 in this Division of the Specification also applies to and is a part of this Section of the Specification. The Section contains requirements, products, and methods of execution that apply to this Section as well as to other Sections of Division 15.

#### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 The following work which is related to the air handling work is specified in other Sections of the Specification:
  - .1 all required starter interlock wiring and 115 volt control wiring;
  - .2 supply of control components and control connections to all components such as motorized dampers associated with automatic control systems;
  - .3 installation of curbs for roof mounted fans;
  - .4 provision of exterior wall louvres and birdscreen;
  - .5 provision of domestic water and drain piping connections to equipment;
  - .6 provision of casings, plenums, ductwork, dampers, grilles, diffusers, and similar system components;
  - .7 provision of heat transfer piping connections to coils;
  - .8 provision of site applied thermal insulation;
  - .9 provision of products-of-combustion detectors in fan equipment for fire alarm system fan shut-down;
  - .10 provision of controls for heat pipes and heat wheels excluding heat pipe actuator which shall be provided by unit manufacturer;
  - .11 provision of variable frequency drives;
  - .12 provision of outdoor air and exhaust air dampers and actuators.

#### 1.3 SHOP DRAWINGS

- .1 Submit shop drawings for all equipment specified in this Section.
- .2 Shop drawings shall be complete with outline drawings, AMCA certified pressure volume performance curves, showing point of operation and AMCA Certified sound power data shall be submitted.
- .3 Include the name of the fan manufacturer in the submission for cabinet fan assemblies.

### PART 2 - PRODUCTS

#### 2.1 AIR HANDLING UNITS

- .1 **Part 1: Schedules for Decentralized HVAC Equipment**

Decentralized Unitary HVAC Equipment Schedule

  1. 1. Rooftop unit schedule
    - A. Schedule is per the project specification requirements.
- .2 **Part 2: HVAC Equipment Insulation**



Decentralized, Rooftop Units:

- 2. 1. Evaporator fan compartment:
  - A. Interior cabinet surfaces shall be insulated with a minimum 1/2-in. thick, minimum 1 1/2 lb density, flexible fiberglass insulation bonded with a phenolic binder, neoprene coated on the air side.
  - B. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- 2. 2. Gas heat compartment:
  - A. Aluminum foil-faced fiberglass insulation shall be used.
  - B. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

**.3 Part 3: Direct-digital Control system for HVAC**

Decentralized, Rooftop Units:

- 3. 1. RTU Open protocol, direct digital controller:
  - A. Shall be ASHRAE 62-2001 compliant.
  - B. Shall accept 18-30VAC, 50-60Hz, and consumer 15VA or less power.
  - C. Shall have an operating temperature range from -40°F (-40°C) to 130°F (54°C), 10% - 90% RH (non-condensing).
  - D. Shall include built-in protocol for BACNET (MS/TP and PTP modes), Modbus (RTU and ASCII), Johnson N2 and LonWorks. LonWorks Echelon processor required for all Lon applications shall be contained in separate communication board.
  - E. Shall allow access of up to 62 network variables (SNVT). Shall be compatible with all open controllers
  - F. Baud rate Controller shall be selectable using a dipswitch.
  - G. Shall have an LED display independently showing the status of serial communication, running, errors, power, all digital outputs, and all analog inputs.
  - H. Shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air quality, compressor lock-out, fire shutdown, enthalpy switch, and fan status/filter status/ humidity/ remote occupancy.
  - I. Shall provide the following outputs: economizer, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, heat stage 3/ exhaust/ reversing valve.
  - J. Shall have built-in surge protection circuitry through solid state polyswitches. Polyswitches shall be used on incoming power and network connections. Polyswitches will return to normal when the "trip" condition clears.
  - K. Shall have a battery back-up capable of a minimum of 10,000 hours of data and time clock retention during power outages.
  - L. Shall have built-in support for Carrier technician tool.
  - M. Shall include an EIA-485 protocol communication port, an access port for connection of either a computer or a Carrier technician tool, an EIA-485 port for network communication to intelligent space sensors and displays, and a port to connect an optional LonWorks communications card.
  - N. Software upgrades will be accomplished by either local or remote download. No software upgrades through chip replacements are allowed.

**.4 Part 4: Electric and Electronic Control System for HVAC**

Decentralized, Rooftop Units:

4.1. General:

- A. Shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-v transformer side. Transformer shall have 75VA capability.
- B. Shall utilize color-coded wiring.
- C. Shall include a central control terminal board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, gas controller, economizer, thermostat, DDC control options, and low and high pressure switches.
- D. The heat exchanger shall be controlled by an integrated gas controller (IGC) microprocessor. See heat exchanger section of this specification.
- E. Unit shall include a minimum of one 8-pin screw terminal connection board for connection of control wiring.

4.2. Safeties:

- A. Compressor over-temperature, over-current. High internal pressure differential.
- B. Low-pressure switch.
  - 1. Units shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
  - 2. Low pressure switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
- C. High-pressure switch.
  - 1. Units shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
  - 2. High pressure switch shall use different color wire than the low pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
- D. Automatic reset, motor thermal overload protector.
- E. Heating section shall be provided with the following minimum protections:
  - 1. High-temperature limit switches.
  - 2. Induced draft motor speed sensor.
  - 3. Flame rollout switch.
  - 4. Flame proving controls.

**.5 Part 5: Sequence of Operations for HVAC Controls**

Decentralized, Rooftop Units:

- 5.1. Refer to Drawings

**.6 Part 6: Panel Air Filters**

Decentralized, Rooftop Units:

- 6. 1. Standard filter section
  - A. Shall consist of factory-installed, low velocity, disposable 2-in. thick fiberglass filters of commercially available sizes.
  - B. Unit shall use only one filter size. Multiple sizes are not acceptable.
  - C. Filters shall be accessible through a dedicated, weather tight access panel.
  - D. 4-in filter capabilities shall be capable with pre-engineered and approved Carrier filter track field installed accessory. This kit requires field furnished filters.

**.7 Part 7: Self-Contained Air Conditioners**

Medium-Capacity Self-Contained Air Conditioners

- 7.1. General
  - A. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing a fully hermetic scroll compressor(s) for cooling duty and gas combustion for heating duty.
  - B. Factory assembled, single-piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
  - C. Unit shall use environmentally sound, Puron refrigerant.
  - D. Unit shall be installed in accordance with the manufacturer's instructions.
  - E. Unit must be selected and installed in compliance with local, state, and federal codes.
- 7.2. **Quality Assurance**
  - A. Unit meets ASHRAE 90.1 minimum efficiency requirements.
  - B. Units are Energy Star certified where sizes are required.
  - C. Unit shall be rated in accordance with AHRI Standard 340/360.
  - D. Unit shall be designed to conform to ASHRAE 15.
  - E. Unit shall be ETL-tested and certified in accordance with ANSI Z21.47 Standards and ETL-listed and certified under Canadian standards as a total package for safety requirements.
  - F. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
  - G. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).
  - H. Unit casing shall be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 5000-hour salt spray.
  - I. Unit shall be designed and manufactured in accordance with ISO 9001.
  - J. Roof curb shall be designed to conform to NRCA Standards.
  - K. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request.
  - L. Unit shall be designed in accordance with UL Standard 1995, ETL listed including tested to withstand rain.
  - M. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.

- N. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.
- O. High Efficient Motors listed shall meet section 313 of the Energy Independence and Security Act of 2007 (EISA 2007).

**7. 3. Delivery, Storage, and Handling**

- A. Unit shall be stored and handled per manufacturer's recommendations.
- B. Lifted by crane requires either shipping top panel or spreader bars.
- C. Unit shall only be stored or positioned in the upright position.

**7. 4. Project Conditions**

- A. As specified in the contract.

**7. 5. Operating Characteristics**

- A. Unit shall be capable of starting and running at 125°F (52°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 340/360 at ± 10% voltage.
- B. Compressor with standard controls shall be capable of operation down to 35°F (2°C), ambient outdoor temperatures. Accessory winter start kit is necessary if mechanically cooling at ambient temperatures below 35°F (2°C).
- C. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.
- D. Unit shall be factory configured and ordered for vertical supply & return configurations.
- E. Unit shall be factory furnished for either vertical or horizontal configuration without the use of special conversion kits. No field conversion is possible.

**7. 6. Electrical Requirements**

- A. Main power supply voltage, phase, and frequency must match those required by the manufacturer.

**7. 7. Unit Cabinet**

- A. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
- B. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60°F / 16°C): 60, Hardness: H-2H Pencil hardness.
- C. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standard 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the gas heat compartment.
- D. Base of unit shall have a minimum of four locations for thru-the-base gas and electrical connections standard. Both gas and electric connections shall be internal to the cabinet to protect from environmental issues.
- E. Base Rail
  - 1. Unit shall have base rails on a minimum of 2 sides.
  - 2. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
  - 3. Holes shall be provided in the base rail for moving the rooftop by fork truck.
  - 4. Base rail shall be a minimum of 16 gauge thickness.

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- F. Condensate pan and connections:
    - 1. Shall be a sloped condensate drain pan made of a non-corrosive material.
    - 2. Shall comply with ASHRAE Standard 62.
    - 3. Shall use a 3/4-in -14 NPT drain connection, through the side of the drain pan. Connection shall be made per manufacturer's recommendations.
  - G. Top panel:
    - 1. Shall be a multi-piece top panel linked with water tight flanges and locking systems.
  - H. Gas Connections:
    - 1. All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location on side of unit (horizontal plane).
    - 2. Thru-the-base capability
      - a. Standard unit shall have a thru-the-base gas-line location using a raised, embossed portion of the unit basepan.
      - b. Thru-the-base provisions/connections are available as standard with every unit. When bottom connections are required, field furnished couplings are required.
      - c.. No basepan penetration, other than those authorized by the manufacturer, is permitted.
  - I. Electrical Connections
    - 1. All unit power wiring shall enter unit cabinet at a single, factory-prepared, knockout location.
    - 2. Thru-the-base capability.
      - a. Thru-the-base provisions/connections are available as standard with every unit. When bottom connections are required, field furnished couplings are required.
      - b. No basepan penetration, other than those authorized by the manufacturer, is permitted.
- 7. 8. Gas Heat**
- A. General
    - 1. Heat exchanger shall be an induced draft design. Positive pressure heat exchanger designs shall not be allowed.
    - 2. Shall incorporate a direct-spark ignition system and redundant main gas valve.
    - 3. Gas supply pressure at the inlet to the rooftop unit gas valve must match that required by the manufacturer.
  - B. The heat exchanger shall be controlled by an integrated gas controller (IGC) microprocessor.
    - 1. IGC board shall notify users of fault using an LED (light-emitting diode).
    - 2. The LED shall be visible without removing the control box access panel.
    - 3. IGC board shall contain algorithms that modify evaporator-fan operation to prevent future cycling on high temperature limit switch.

4. Unit shall be equipped with anti-cycle protection with one short cycle on unit flame rollout switch or 4 continuous short cycles on the high temperature limit switch. Fault indication shall be made using an LED.

C. Standard Heat Exchanger construction

1. Heat exchanger shall be of the tubular-section type constructed of a minimum of 20-gauge steel coated with a nominal 1.2 mil aluminum-silicone alloy for corrosion resistance.
2. Burners shall be of the in-shot type constructed of aluminum-coated steel.
3. Burners shall incorporate orifices for rated heat output up to 2000 ft (610m) elevation. Additional accessory kits may be required for applications above 2000 ft (610m) elevation, depending on local gas supply conditions.
4. Each heat exchanger tube shall contain multiple dimples for increased heating effectiveness.

D. Induced draft combustion motor and blower

1. Shall be a direct-drive, single inlet, forward-curved centrifugal type.
2. Shall be made from steel with a corrosion-resistant finish.
3. Shall have permanently lubricated sealed bearings.
4. Shall have inherent thermal overload protection.
5. Shall have an automatic reset feature.

7.9. **Coils**

A. Standard Aluminum Fin/Copper Tube Coils:

1. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
2. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
3. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

7.10. **Refrigerant Components**

A. Refrigerant circuit shall include the following control, safety, and maintenance features:

1. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.
2. Refrigerant filter drier - Solid core design.
3. Service gauge connections on suction and discharge lines.
4. Pressure gauge access through a specially designed access screen on the side of the unit.

B. Compressors

1. Unit shall use fully hermetic, scroll compressor for each independent refrigeration circuit.

2. Models shall be available with 2 compressor/2-stage cooling.
3. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
4. Compressors shall be internally protected from high discharge temperature conditions.
5. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.
6. Compressor shall be factory mounted on rubber grommets.
7. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.
8. Crankcase heaters shall not be required for normal operating range, unless provided by the factory.

**7.11. Filter Section**

- A. Filters access is specified in the unit cabinet section of this specification.
- B. Filters shall be held in place by a preformed, slide-out filter tray, facilitating easy removal and installation.
- C. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.
- D. Filters shall be standard, commercially available sizes.
- E. Only one size filter per unit is allowed.
- F. 4-in filter capability is possible with a field installed pre engineered slide out filter track accessory. 4-in filters are field furnished.

**7.12. Evaporator Fan and Motor**

- A. Evaporator fan motor:
  1. Shall have inherent automatic-reset thermal overload protection or circuit breaker.
  2. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.

**B. Belt-driven Evaporator Fan:**

1. Belt drive shall include an adjustable-pitch motor pulley and belt break protection system.
2. Shall use rigid pillow block bearing system with lubricant fittings at accessible bearing or lubrication line.
3. Blower fan shall be double-inlet type with forward-curved blades.
4. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
5. Standard on all 17-28 size Humidi-MiZer models.

**7.13. Condenser Fans and Motors**

- A. Condenser fan motors:
  1. Shall be a totally enclosed motor.

2. Shall use permanently lubricated bearings.
  3. Shall have inherent thermal overload protection with an automatic reset feature.
  4. Shall use a shaft-down design.
- B. Condenser Fans:
1. Shall be a direct-driven propeller type fan.
  2. Shall have galvalum blades riveted to corrosion-resistant steel spiders and shall be dynamically balanced.

**7.14. Special Features Options and Accessories**

- A. Staged Air Volume System (SAV) for 2-stage cooling models only:
1. Evaporator fan motor:
    - a. Shall have permanently lubricated bearings.
    - b. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating.
    - c. Shall be Variable Frequency duty and 2-speed control.
    - d. Shall contain motor shaft grounding ring to prevent electrical bearing fluting damage by safely diverting harmful shaft voltages and bearing currents to ground.
- B. Variable Frequency Drive (VFD). Only available on 2-speed indoor fan motor option (SAV):
1. Shall be installed inside the unit cabinet, mounted, wired and tested.
  2. Shall contain Electromagnetic Interference (EMI) frequency protection.
  3. Insulated Gate Bi-Polar Transistors (IGBT) used to produce the output pulse width modulated (PWM) waveform, allowing for quiet motor operation.
  4. Self diagnostics with fault and power code LED indicator. Field accessory Display Kit available for further diagnostics and special setup applications.
  5. RS485 capability standard.
  6. Electronic thermal overload protection.
  7. 5% swinging chokes for harmonic reduction and improved power factor.
  8. All printed circuit boards shall be conformal coated.
- C. Standard Integrated Economizers :
1. Integrated, gear-driven opposing blade design type capable of simultaneous economizer and compressor operation.
  2. Independent modules for vertical or horizontal return configurations shall be available. Vertical and horizontal return modules shall be available as a factory installed option.
  3. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.
  4. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.



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5. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
6. Standard models shall be equipped with low-leakage dampers, not to exceed 2% leakage at 1 in. wg pressure differential. Economizer controller on electromechanical units shall be Honeywell W7212 that provides:
  - a. Combined minimum and DCV maximum damper position potentiometers with compressor staging relay.
  - b. Functions with solid state analog enthalpy or dry bulb changeover control sensing.
  - c. Contain LED indicates for:
    - I) When free cooling is available
    - II) When module is in DCV mode
    - III) When exhaust fan contact is closed
7. Ultra low leak EconoMiSer X system shall be available on models with SAV 2-speed Variable Frequency Drive (VFD) systems. Only available on 2-speed indoor fan motor systems with electromechanical, ComfortLink or RTU Open controls.
  - a. Maximum damper leakage rate to be equal to or less than 4.0 cfm/sq. ft. at 1.0 in. w.g., meeting or exceeding ASHRAE 90.1 requirements. Economizer controller on electromechanical units shall be Honeywell W7220 that provides:
    - b. 2-line LCD interface screen for setup, configuration and troubleshooting.
    - c. On-board fault detection and diagnostics
    - d. Sensor failure loss of communication identification
    - e. Automatic sensor detection
    - f. Capabilities for use with multiple-speed indoor fan systems
    - g. Utilize digital sensors: Dry bulb and Enthalpy
8. Shall be capable of introducing up to 100% outdoor air.
9. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air.
10. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.
11. Dry bulb outdoor air temperature sensor shall be provided as standard. Outdoor air sensor setpoint shall be adjustable and shall range from 40 to 100°F / 4 to 38°C. Additional sensor options shall be available as accessories.
12. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.
13. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy. A remote potentiometer may be used to override the damper setpoint.
14. Dampers shall be completely closed when the unit is in the unoccupied mode.

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15. Economizer controller shall accept a 2-10 Vdc CO<sub>2</sub> sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor air damper to provide ventilation based on the sensor input.
  16. Compressor lockout sensor shall open at 35°F (2°C) and close closes at 50°F (10°C).
  17. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
  18. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.
- D. Unit-Mounted, Non-Fused Disconnect Switch:
1. Switch shall be factory-installed, internally mounted.
  2. National Electric Code (NEC) and ETL approved non-fused switch shall provide unit power shutoff.
  3. Shall be accessible from outside the unit.
  4. Shall provide local shutdown and lockout capability.
- E. Flue Discharge Deflector:
1. Flue discharge deflector shall direct unit exhaust vertically instead of horizontally.
  2. Deflector shall be defined as a “natural draft” device by the National Fuel and Gas (NFG) code.
- F. Centrifugal Propeller Power Exhaust:
1. Power exhaust shall be used in conjunction with an integrated economizer.
  2. Independent modules for vertical or horizontal return configurations shall be available.
  3. Horizontal power exhaust is shall be mounted in return ductwork.
  4. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0-100% adjustable setpoint on the economizer control.
- G. Roof Curbs (Vertical):
1. Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.
  2. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
  3. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
- H. Indoor Air Quality (CO<sub>2</sub>) Sensor:
1. Shall be able to provide demand ventilation indoor air quality (IAQ) control.
  2. The IAQ sensor shall be available in duct mount, wall mount, or wall mount with LED display. The setpoint shall have adjustment capability.
- I. Hinged Access Panels
1. Shall provide easy access through integrated quarter turn latches.

2. Shall be on major panels of – filter, control box, fan motor and compressor.

### 2.2 MAKE-UP AIR UNITS (MUA)

R-IBT Specification

#### TYPICAL SPECIFICATIONS

Model: R-IBT

#### Description:

An Indirect-fired gas heating and ventilating unit(s), as indicated on the drawings shall be furnished. Orientation shall be Horizontal (Down) (Side) (Up) discharge. Unit(s) shall be factory assembled, tested and shipped as a complete packaged assembly, for indoor or outdoor mounting, consisting of the following:

- Gas furnace;
- Centrifugal blower (forward-curved double width/double inlet);
- Motor starter with thermal overload protection;
- Motor and drive assembly;
- Fuel burning and safety equipment;
- Temperature control system, and
- Gas piping.

#### Approvals:

Unit(s) assembly shall be tested in accordance with Standard, ANSI Z83.8-2006 and CSA 2.6-2006 and shall bear the ETL label. The duct furnace shall be certified by the American Gas Association and approved by the Canadian Gas Association.

#### Construction:

##### Housing Standard

Unit housing shall be constructed of 20 Gauge G-90 galvanized steel. The wall panels and roof panels shall be fabricated by forming double-standing, self-locking seams that require no additional support. The floor and wall panels shall be caulked air tight with a silicone caulk. All casing panels shall be attached with sheet-metal screws or rivets, which can be removed to field service large components. The unit base shall be suitable for curb or flat mount. The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly and burner. Housing construction should be suitable for outdoor or indoor installation.

All doors and at least one side of every sheet metal surface of the unit separating two air-masses of different air temperatures shall be faced with properly secured 1" aluminum-faced insulation for condensation prevention.

The discharge of the unit (Down/Side/Up) shall be internal to the heating module containing the furnaces.

All electrical controls on the control board shall be mounted in an isolated, fully enclosed and insulated vestibule, completely separated from any combustion air, but accessible for servicing needs.

All furnace exhaust flues shall be of double-wall construction. All furnace exhaust flue connections and roof-penetration seams shall be sealed with High-Temp Fire-Barrier 2000+ type silicone caulking. All unit housings, sizes 1-3, shall be equipped with Internal Air Distribution Screens on the upstream side of each furnace heat-exchanger.

All gas valves and electrical safety-limits shall be mounted within the burner vestibule; wiring to these components shall be properly secured and away from all high temperature metal surfaces. The burner vestibule shall be an integral part of the unit and not extend outside the exterior casing of the unit and not exposed to the main air stream.

If an outdoor unit, high wind rain caps shall be installed at the termination of the furnace discharge flues.

The vestibule full-size door shall provide easy access to controls and gas-train components. Blower door shall provide easy access to blower, motor and drives. Access doors shall be provided on both front and back side of unit providing full access to every part of the unit.

### **Blower**

Blower(s) shall be forward-curved, centrifugal, Class I or II (depending on requirements of the application), double width, double inlet, constructed G-90 galvanized steel. Unit shall have a heavy-duty, solid-steel shaft. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, *Balance Quality and Vibration Levels for Fans*. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be securely attached to the wheel inlet ring. The wheel shall be firmly attached to the fan shaft with set screws and keys. The blower assembly shall be isolated from the fan structure with vibration isolators.

Blower capacity shall be 1000 CFM at 70 degrees F standard air, .75 external static press.

External Static: The sum of duct loss plus duct component static- Example: louvers, diffusers. All blowers shall be tested and set at rated speed after being installed in the factory-assembled unit.

### **Motor & Motor Compartment**

Motors shall be heavy duty ball bearing type and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel and shall be designed to provide easy adjustment of belt tension. Blower motor shall be suitable for operation on 600 volts/60 cycle, 3 phase power. Blower motor shall be a 1.0 HP motor, Open Drip Proof.

### **Shaft & Bearings**

Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings shall be selected for a minimum (L50) life in excess of 200,000 hours of operation at maximum cataloged operating speed. They shall be designed for, and individually tested specifically for use in air handling applications.

### **Belts & Drives**

Belts shall be oil and heat resistant, non-static, grip-notch type. Drives shall be cast type, precision machined and keyed and secured attached to the fan and motor shafts. Fan operating speed shall be factory set using adjustable pitch motor pulleys; motors over 3 HP will come standard with double groove pulleys.

### **Burner & Heat Exchanger**

The gas burner shall be an indirect-fired, push-through type, sized to provide an output of 108,000 BTU/hr using (natural) (LP) gas at an inlet-supply pressure to the unit of 7" inches water column (7" w.c. minimum Nat. Gas, 11" w.c. minimum LP Gas).

The burner shall be capable of heating the entire air supply from .30\_F° 70F° (100 degrees F temperature rise). Burner shall be a tubular in-shot fired design capable of using natural or LP type gas. Each burner ignition shall be of the direct-spark design with remote flame sensing at inlet of the last firing tube of the gas manifold. Each burner ignition module shall be pre-programmed with an ignition sequence comprised of a 1 minute pre-purge, 1 min inter-purge, 2 minute post-purge, 15 second ignition, 3 trials for ignition, and 60 min lockout.

Direct-sparking sequence shall last through the complete during of the trial for ignition period for guaranteed light-off. Burner shall always be lit at maximum gas flow and combustion airflow for guaranteed light-off. Each burner ignition module shall have LED indicators for troubleshooting and a set of exposed prongs for testing flame indication signal. All furnaces shall be controlled by an electronic vernier-type fully modulating control system capable of achieving 80% combustion efficiency over the entire gas firing range of the unit.

Each furnace shall have:

- A minimum turndown ratio of 6:1 for natural gas and 5:1 for LP gas.
- Each furnace heat exchanger shall be a bent-tube style design made entirely of type 409 stainless steel.
- Each furnace shall include a blocked vent safety airflow switch with high temperature silicone tubing operating off of absolute pressure measured inside of the power-vent blower housing.
- Each furnace shall include a high temperature auto-recycling limit with a maximum non-adjustable set-point of 200F.
- Each furnace shall include a manual reset high temperature flame roll out switch with a non-adjustable set-point of 325F.
- Each Furnace shall be accessible from both sides of unit.
- Each Furnace shall include a power-vent assembly for exhausting flue gases with a type PSC type motor that is securely mounted with rubber vibration isolators and easily accessible/removable for service.
- Every heat-exchanger shall have a manufacturer-backed 10-year pro-rated warranty.

## SECTION 15850 – AIR HANDLING

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- Every power-vent blower motor and housing shall have a standard 1-year manufacturer-backed warranty.

Each furnace module gas inlet shall be equipped with a 0-35" w.c. gas pressure gauge. A 0-10" w.c. gas pressure gauge shall be installed on the gas manifold of each furnace.

### GAS EQUIPMENT

#### Standard

All gas equipment shall conform to local-Code requirements

Components:

1. Modulating-gas valve
2. On/off redundant gas valve
3. Burner
4. Main-gas shut-off valve
5. Main-gas regulator
6. Two solenoid valves

**All gas manifold components shall be piped and wired at the factory.**

### SAFETY CONTROLS

#### Standard

1. Motor starter with adjustable overloads
2. Main air-flow safety switch
3. Electronic flame-safety relay
4. High-temperature limit switch
5. Non-fused disconnect
6. Flame roll-out switch
7. Main-gas regulator
8. Two solenoid valves
9. Modulating-gas valve
10. Burner
11. Combustion air-proving switch

#### Optional

- Adjustable low temperature blower-safety control with bypass timer to shut down unit, if discharge temperature drops below setting.

### ACCESSORIES

- **Inlet Dampers:** Manufacturer shall provide and install on unit, when possible, a two-position, motor-operated damper with internal end switch to energize the blower-starter circuit, when damper is 80% open. Blades shall be a maximum of 6" wide 16 Gauge G-90 galvanized steel shall be made to guarantee the absence of noticeable vibration at design air velocities. Damper blades to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb seals to be flexible metal, compression type.
- **Fresh-Air Inlet Hood/Filter Combination:** Shall be constructed of G-90 galvanized steel with birdscreen and (2") cleanable filters supported by internal slides mounted in the inlet face of the hood.
- **Curb:** 24" curb shall be constructed of 20 ga or greater G-90 galvanized steel as a completed welded assembly.

**Cooling Coil Section:** Cooling coil section shall be bolted directly to intake of the blower section. Coil section to be designed to fit onto common curb with main unit. Base of coil section to be constructed same as main unit with double pitch stainless steel drain pan for coil. Casing and roof to be 20 ga. G-90 galvanized construction. Inside of section to be fully insulated with foil back insulation. DX or chilled water coil to meet scheduled requirements.

### TEMPERATURE CONTROL SYSTEMS

**HMI Control:** One HMI or Human-Machine Interface to be provided standard. Space HMI or room sensor shall be provided for temperature control utilizing space temperature. Additional HMIs or room sensors can be provided for space averaging. Cat5 connections shall be utilized between all HMIs. All settings and set points shall be able to be controlled at any HMI.

## SECTION 15850 – AIR HANDLING

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**Activate Based on:** Shall have the ability to activate heating/cooling based on the following.

- Intake temperature only
- Space temperature only
- Intake and space temperature
- Intake or space temperature

**Tempering Mode:** Shall have the ability to control heating/cooling based on the following.

- Discharge – Unit shall modulate to maintain discharge temperature.
- Space – Unit shall modulate to maintain discharge temperature.
- BAS – Unit shall be controlled via call for fan, call for heat, call for cool (optional), as well as a modulating heat input (0-20mA, 4-20mA, 0-10V, or 2-10V).
- (Optional) DDC – Unit shall be controlled via a DDC controller. Protocols to include BACnet or Lonworks.

**Blower Mode:**

- Manual (On) – Blower shall run constantly regardless of heating/cooling based on blower on/off button on HMI.
- Auto – Blower shall only run on a call for heating or cooling.
- Interlock (Off) – Blower shall only run when unit interlock is energized.

**Scheduling (Optional):** Shall have the ability for 7 day scheduling.

- Shall have the ability to schedule 2 Occupied periods per day.
- Separate temperature set points for Occupied and Unoccupied periods.
- Separate Blower Modes for Occupied and Unoccupied periods.
- Occupied Override.

**Service Functionality:**

- Ability to monitor temperatures and VFD feedback real-time throughout unit.
- Test Fan, Heat (high/low fire setting) and Cooling.
- Fault history storing past twenty faults.
- VFD parameter adjustment through HMI.

### Re-Circulating Control Options

**Manual/0-10V Control:** The dampers can be manually controlled from the HMI in the unit or from a remote HMI to any position from 0% to 100% fresh air to match building ventilation requirements.

**Field Wired Control (Two Position):** The dampers can be controlled by a two position switch (field supplied switch device) to open the fresh air to 100%.

**Outdoor Air Percentage:** The dampers can be controlled from the HMI in the unit or from a remote HMI to any position from 0% to 100%. The IBT board utilizes an algorithm to alter its 0-10V output to the mixing box damper to maintain an exact outdoor air percentage based on entering and leaving temperatures.

**Static Pressure Control (Photohelic):** The dampers can be controlled by a building static pressure control. This controller will sense the difference between pressure inside the building and pressure outside the building, and position the dampers to maintain the pressure setting on the controller.

**Building Automation System (BAS) Control:** The supply and return dampers will modulate based on a 0-10 VDC signal from a building automation system.

**Schedule Control:** The supply and return damper will change based on the schedule; the unit will maintain the appropriate outdoor air percentage based on the schedule state.

### VAV OPTIONS

**VAV (Static Pressure Control):** A factory supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled by a field wired Static Pressure Controller which measures building pressure and uses auxiliary inputs on the IBT control board to accelerate or decelerate the blower speed to maintain the building pressure set on the Static Pressure Controller.

**VAV (Manual):** A factory-supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled by a preset speed on the IBT control board.

**VAV (Preset Speeds) :** A factory-supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled using auxiliary pins on the IBT control board to switch between preset speeds.

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**VAV (0-10VDC)** : A factory-supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled using external 0-10VDC signal to vary blower speed.

### WIRING AND ELECTRICAL

#### Standard

The control circuit voltage shall be 24 volts.

A control transformer shall be provided.

Unit shall have standing 120 Vac power.

The control wiring shall be carried in wire channel or conduit.

Wiring in control enclosures shall be in accordance with the National Electrical Code and the local code, as it may affect the installation.

Motor starter shall be provided.

Starter shall be line voltage, definite purpose type.

Unit(s) shall be complete with all items such as relays, starters, switches, safety controls, conduit and wire as previously mentioned, and as required for proper operation.

All factory-mounted controls shall be factory prewired to the unit control panel.

#### Optional

- Single point electrical connection shall be supplied.
- Convenience outlet shall be provided on the control board with 120 Vac service.
- Freeze-stat shall be provided with adjustable temperature set point to shut down the main blower in case of burner failure.
- Dirty filter airflow switch with LED indicator light on remote panel.
- Cabinet heater strip with thermostat.
- Variable Frequency Drive for main blower motor.

#### FACTORY TESTED

Unit(s) shall be operated, tested and set at the factory using job-site conditions for electrical and gas input. All operating and safety controls shall be tested and set at the factory. Adjustable, or fixed sheaves shall be set for proper RPM at specified conditions. Gas-pressure regulator shall be set for specified burning rate at specified inlet pressure.

### SERVICE AND PARTS

- The supplier shall furnish gas piping schematics, **as built** wiring connection and control-circuit diagrams, dimension sheets and a full description of the unit(s). Service manuals, showing service and maintenance requirements, shall be provided with each unit.

### DU-HRA Specification

#### TYPICAL SPECIFICATIONS

Model: DU-HRA

**Description:** Fan shall be a spun aluminum and G90 Galvanized, roof or wall mounted, direct drive, upblast centrifugal exhaust ventilator.

Fans up to and including models with a 24" nominal wheel and a 2 HP motor are suitable for wall mounting

**Application:** Centrifugal roof exhausters are engineered to discharge grease laden vapors, fumes and other contaminants vertically away from the building.

**Certifications:** All models shall be ETL Listed and comply with UL705 (electrical) Standards and CSA Std C22.2, No 113. Models 12 thru 85 are ETL Listed and comply with UL762 Standards. Fan shall bear the AMCA certified ratings seal for sound and air performance.

#### Construction:

##### Housing

The fan windband shall be constructed of heavy gauge aluminum or G90 Galvanized and shall be spun on an automatic lathe to provide consistent dimensions. Horizontal and vertical internal supports shall be used to securely fasten the windband to the discharge apron to provide rigidity for hinging and added strength to reduce shipping damage. The discharge apron shall have a rolled bead for added strength.

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### **Base**

The base shall be constructed of galvanized steel for improved rigidity. Base corners shall be welded to provide strength and support for hinging and cleaning and to prevent leakage into the building.

### **Wheel**

The fan wheel shall be centrifugal backward inclined and non-overloading. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, *Balance Quality and Vibration Levels for Fans*. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be welded to the wheel inlet cone. In the event that balancing weights are required they shall be riveted to the blades or wheel. The wheel inlet shall overlap the fan base inlet for maximum performance and efficiency. The wheel shall be firmly attached to the motor shaft with two set screws.

### **Motor & Motor Compartment**

Standard 115 volt, open drip motors shall be permanently lubricated, rated for continuous duty and thermally protected. Motors shall be mounted out of the airstream and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel. The motor compartment shall be cooled by outside air drawn through an extruded aluminum conduit tube. To seal the conduit tube passage and prevent noise silicone rubber grommets shall isolate the conduit tube from the fan housing. The motor compartment shall be of a two-piece construction with the cap having quick release clips to provide quick and easy access to the motor compartment.

### **Grease Spout**

A grease spout made of aluminum tubing shall be welded to the fan housing. The weld shall be factory tested to ensure it will not leak.

### **Nylon Washers**

To provide a tight seal all fasteners in the fan housing shall be backed with nylon washers.

**Product: Fan shall be model DU-HRA as manufactured by RUPP Air Systems.**



**2.3 IN-LINE FANS**

- .1 Greenheck Fan Corp. in-line fans each as per the drawing schedule, AMCA Air and Sound performance certified and bearing the seal and as specified below.
- .2 Model "BSQ" and "SQ" fans shall be AMCA sound and air performance certified and bear the seal, and shall be complete with:
  - .1 A heavy-gauge, reinforced galvanized steel fan housing lined with 1/2" (12 mm) thick fiberglass acoustic insulation and complete with hanging brackets for spring isolators at each corner, two (2) removable access panels sized to permit easy access to all internal components;
  - .2 A removable, non-overloading, statically and dynamically balanced, backwardly inclined fan wheel keyed to a ground and polished steel shaft;
  - .3 Permanently sealed and lubricated pillow block ball bearings selected for a minimum (L50) life of 200,000 hours at maximum catalogue conditions;
  - .4 Model "BSQ" fans shall have a drive sized for minimum of 150% of driven horsepower;
  - .5 A motor as specified in Section 15050, pre-wired to a disconnect switch mounted on the housing.
- .3 Model "CSP" fans shall be AMCA air and sound performance certified and bear the seal and shall be complete with:
  - .1 A galvanized steel housing with 1/2" (12 mm) thick acoustic insulation and complete with polystyrene grille and mesh filter, adjustable mounting brackets, and duct connection collars with discharge backdraft damper;
  - .2 A removable motor-fan assembly consisting of a permanently lubricated, vibration isolated motor with power cord and plug connected to an internal terminal box with receptacle and direct connected to a dynamically balanced, forward curved centrifugal fan wheel.
  - .3 Unless otherwise noted, all steel components except for galvanized components shall be finished with thermally fused powdered epoxy.
  - .4 Acceptable manufacturers are Greenheck Fan Corp., Loren Cook, ACME, Carnes, JennFan, Breidert, and Penn Ventilator Canada Ltd.

**2.4 ROOF MOUNTED EXHAUST FANS**

- .1 Greenheck Fan Corp. roof mounted centrifugal fans each as per the drawing schedule, AMCA Air and Sound performance certified and bearing the seal and as specified below.
- .2 Model "GB", belt drive fans shall be complete with:
  - .1 a heavy-gauge spun aluminum housing and aluminum curb cap with stainless steel fastenings;
  - .2 a non-overloading, statically and dynamically balanced, all aluminum construction fan wheel and hub secured to an anti-corrosion treated shaft;
  - .3 permanently sealed and lubricated pillow block ball bearings selected for a minimum (L50) life of 200,000 hours at maximum catalogue conditions;
  - .4 a drive sized for minimum of 150% of driven horsepower;
  - .5 a motor as specified in Section 15050, mounted in a force cooled compartment isolated from the exhaust air stream and pre-wired to a disconnect switch mounted under the fan housing;

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- .6 a vinyl coated or galvanized heavy-gauge steel wire birdscreen;
  - .7 a gravity type, multi-leaf, felt-edged, spring loaded backdraft damper;
  - .8 a matching pre-fabricated roof mounting curb.
- .3 Model “CUBE”, belt drive fans shall be complete with:
- .1 a heavy-gauge spun upblast aluminum housing and aluminum curb cap with stainless steel fastenings;
  - .2 a non-overloading, statically and dynamically balanced, all aluminum construction fan wheel and hub secured to an anti-corrosion treated shaft. Motor compartment shall be protected from excessive heat by an insulating baffle;
  - .3 permanently sealed and lubricated pillow block ball bearings selected for a minimum (L50) life of 200,000 hours at maximum catalogue conditions;
  - .4 a drive sized for minimum of 150% of driven horsepower;
  - .5 a motor as specified in Section 15050, mounted in a force cooled compartment isolated from the exhaust air stream and pre-wired to a disconnect switch mounted under the fan housing;
  - .6 a vinyl coated or galvanized heavy-gauge steel wire birdscreen;
  - .7 a gravity type, multi-leaf, felt-edged, spring loaded backdraft damper;
  - .8 a matching pre-fabricated roof mounting curb
- .9 Acceptable manufacturers are Greenheck Fan Corp., Loren Cook, ACME, Carnes, JennFan, Breidert, and Penn Ventilator Canada Ltd.

### 2.5 PADDLE WHEEL FANS

- .1 Wilcorp Manufacturing Ltd., ceiling fans as scheduled, each complete with a sealed motor housing, sealed lifetime lubricated bearings, 200 mm long down rod, mounting assembly, safety clip, a wire guard. Supply a No. 31B wall mounting speed controller capable of controlling a minimum of four (4) fans, with faceplate.
- .2 Acceptable manufacturers are Wilcorp Manufacturing, Banvil and Canarm.

### 2.6 RANGE HOODS

- .1 Reversomatic Manufacturing Ltd., Series 3000 “Deluxe” ducted range hoods, each per the drawing schedule, CSA certified, rotary solid state speed control providing infinite range, rotary light control switch, backdraft damper, with light lens and permanent, washable aluminium mesh grease filter(s).
- .2 Reversomatic Manufacturing Ltd., standard “Custom Hoods”, 900 mm (36”) island hoods, each per the drawing schedule, CSA certified, rotary solid state speed control providing infinite range, rotary light control switch, backdraft damper, with light lens, permanent, washable aluminium mesh grease filter(s), 200 mm (8”) round duct connector support system, and fully adjustable mounting system.
- .3 Acceptable manufacturers are Reversomatic Manufacturing, Broan, and Air King.

### 2.7 AIR FILTERS

- .1 Camfill-Farr, air filters as per the drawing schedule. All filters shall be ULC listed and labelled and rated as Class I or Class II.
- .2 Pre-filter shall have a 20-25% average efficiency when tested by the ASHRAE 52.1-92 test method. The frame shall be constructed of high strength moisture resistant “beverage” board. Two mating die-cut boxes are bonded together to form a double wall construction. The media pad support retainers shall be bonded to the media on both the air entering and leaving sides.

- .3 Main filter shall have a 80-85% average efficiency when tested by the ASHRAE 52.1-92 test method. Filter media shall be of microfine glass laminated to a reinforcing backing to form a uniform lofted media blanket. Media blanket shall be formed into uniform tapered radial pleates and bonded to a stiffened backing bonded to the downstream side of the media to prevent media vibration. The media shall be mechanically and chemically bonded to the inside periphery of the enclosing frame to prevent air bypass. The enclosing frame shall be constructed of an alloy of zinc, aluminium and steel. Media support stabilizers shall be mechanically fastened to diagonal support members of the same construction to create a rigid and durable enclosure.
- .4 Acceptable manufacturers are Farr, AFF-Canada and Airguard Industries.

**2.8 AIR FILTER GAUGES**

- .1 Dwyer Industries Inc. Series 2000 differential pressure gauge with a 0-500 Pa range, accurate to within 2% of full scale and complete with all required mounting and connection accessories. The 120 mm diameter dial shall have a zero (0) point adjustment and graduations in inches of wc.

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF AIR HANDLING UNITS**

- .1 Provide air handling units for systems as shown.
- .2 Secure each fan, unless otherwise noted, in place on vibration isolation as shown.
- .3 Provide adjacent factory made sections for systems as shown and secure in place as for fan cabinets but less vibration isolation hardware. Ensure that each section and the associated cabinet fan is level and plumb, and properly aligned.
- .4 Supply a sheave change for each fan with fixed type drives and turn over to Consultant, on site.
- .5 Where variable frequency drives are scheduled, provide variable frequency drives for fans and heat wheels. Install drives where shown on the drawings. "Load" and "line" side wiring to and from the variable frequency drive shall be the responsibility of Division 16.
- .6 Provide condensate drainage piping for all sections with drain pans. Extend and terminate condensate drainage piping over the nearest funnel floor drain.
- .7 Ensure that all condensate drainage piping from sections with drain pans are adequately trapped.

**3.2 INSTALLATION OF ENERGY RECOVERY VENTILATOR UNITS**

- .1 Provide energy recovery ventilator units for systems as shown.
- .2 Suspend each unit with hanger rods and where shown and/or scheduled, vibration isolation spring hangers, independent of ductwork connected hereto.

**3.3 INSTALLATION OF IN-LINE FAN**

- .1 Provide in-line fans where shown.
- .2 Suspend each fan with hanger rods and where shown and/or scheduled, vibration isolation spring hangers, independent of ductwork connected hereto.

**3.4 INSTALLATION OF ROOF MOUNTED EXHAUST FANS**

- .1 Provide roof mounted exhaust fans where shown.
- .2 Supply a prefabricated mounting curb for each fan and hand the curbs to the roofing trade on site for installation and flashing into roof construction as part of the roofing work.
- .3 Install the fans on the curbs.

**3.5 INSTALLATION OF PADDLE WHEEL FANS**

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- .1 Provide ceiling fans in the Gymnasium where shown.
- .2 Turn each fan over to the electrical trade for mounting to an outlet box. Provide a rigid, wire guard for each fan and secure in place in accordance with the manufacturer's recommendations and to the Consultant's approval. The wire guards shall be complete with an access hatch to allow the fans to be cleaned. Provide safety chain and clips as required to ensure that the wire guards or fans will not accidentally fall.
- .3 Supply a speed controller for each fan and turn the controllers over to the electrical trade for installation.
- .4 Provide a relay for each fan and turn over to the electrical trade for mounting in series with the speed controller. The relay is to allow the DDC system to enable and disable the fan operation.

### 3.6 INSTALLATION OF RANGE HOODS

- .1 Provide range hoods where shown.
- .2 Secure range housing in place from the structure.
- .3 Install fan-motor assemblies and plug motor cord into the fan housing receptacle. Install exhaust grilles and other accessories.

### 3.7 INSTALLATION OF AIR FILTERS

- .1 Provide all required air filters, located and arranged as shown and scheduled.
- .2 Provide all required filter assembly frames and install to prevent air by-pass and to permit easy filter removal. Construct frames from the same material as the plenum, casing or duct the filters are associated.
- .3 When air handling systems are complete and ready for start-up and testing, but building finishes are not complete and cleaning is not complete, provide minimum 20% average dust spot efficient (atmospheric) temporary glass fibre media in place of permanent filters prior to fan start-up, and provide temporary media over all return air openings in dirty, dusty, incomplete areas.
- .4 Prior to application for a Certificate of Substantial Performance, and when the systems are ready for air balancing, remove temporary media and install permanent filters.
- .5 For each filter bank, supply a spare set of replacement media and turn the filters over to the Project Manager prior to application for a Certificate of Substantial Performance of the Work.

### 3.8 INSTALLATION OF AIR FILTER GAUGES

- .1 Provide a filter gauge for each main air handling system. For systems with pre-filters and after-filters, install the gauge across the after-filters.
- .2 Secure gauges in place on the filter section casing in an easily readable location. Adjust each gauge to suit the design pressures of the system with new fresh filters in place.

**END OF SECTION 15850**

## **SECTION 15880 – AIR DISTRIBUTION**

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## **SECTION 15880 – AIR DISTRIBUTION**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 Section 15010 in this Division of the Specification applies to and is a part of this Section of the Specification.
- .2 Section 15050 in this Division of the Specification also applies to and is a part of this Section of the Specification. The Section contains requirements, products, and methods of execution that apply to this Section as well as to other Sections of Division 15.

#### **1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

1.2.1 The following work which is related to the air distribution work is specified in other Sections of the Specification:

- 1.2.1.1 all required starter interlock wiring and 115 volt control wiring;
- 1.2.1.2 provision of control components and control connections, excluding control dampers. This section is responsible for provision of dampers such as outdoor air, exhaust air and other dampers excluding those specified within air handling units; Note: Except as otherwise noted, dampers shall be provided by this section and damper actuators will be by Section 15900;
- 1.2.1.3 provision of curbs for ducts penetrating water proof floors;
- 1.2.1.4 installation of roof construction of flashing accessories for flues and stacks penetrating the roof;
- 1.2.1.5 provision of condensate drain and domestic water piping connections to equipment;
- 1.2.1.6 provision of heat transfer piping connections to coils;
- 1.2.1.7 provision of site applied thermal insulation;
- 1.2.1.8 provision of products of combustion detectors in ductwork and/or casings for fire alarm system fan shut down;
- 1.2.1.9 provision of caulking around perimeter of exterior wall louvres;
- 1.2.1.10 provision of air handling equipment;
- 1.2.1.11 provision of air handling heating, adjusting and balancing;
- 1.2.1.12 provision of exterior wall louvres and birdscreen.

#### **1.3 SHOP DRAWINGS**

- 1.3.1 Submit shop drawings for all products specified in Part 2.

### **PART 2- PRODUCTS**

#### **2.1 GALVANIZED STEEL DUCTWORK**

- 2.1.1 Rectangular or square ductwork shall be prime lock forming quality, galvanized sheet steel to ASTM 653/653M, with satin coated finish on all exposed ductwork, no coating on all other ductwork, with metal gauges in accordance with published SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit the duct configuration and classification.

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- 2.1.2 Alpha Industries Limited, “Free-Flow,” round (spiral) ductwork shall be prime lock forming quality, galvanized sheet steel to ASTM A653/653M, satin coated finish on ductwork to be painted, G60 coating on all other ductwork, spiral lockseam, factory fabricated fittings with fully welded seams and joints, with metal gauges in accordance with published SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit the duct configuration and classification.
- 2.1.2.1 acceptable manufacturers are Alpha Industries Limited, Flexmaster Ltd., Don-Park, Ecco Manufacturing and United McGill Corp.
- 2.1.3 Ductmate Canada Limited, “DUCTMATE,” “SpiralMate,” gasketed, sealed, flanged joint system components are acceptable in rectangular galvanized steel duct construction:
- 2.1.3.1 acceptable manufacturers are Ductmate Canada Limited and Nexus PDQ.

### 2.2 SHEET ALUMINIUM DUCTWORK

- 2.2.1 Lock forming grade, alloy No. 3003 H14 sheet aluminium with metal thickness in accordance with published SMACNA HVAC Duct Construction Standard Metal and Flexible, to suit the duct configuration and classification.
- 2.2.2 Alpha Industries Limited, “Free-Flow,” round (spiral), aluminium ductwork constructed of lock forming grade, alloy No. 3003 H14 sheet aluminium to ASTM B209, spiral lockseam, factory fabricated fittings with fully welded seams and joints, with metal gauges in accordance with published SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit the duct configuration and classification.
- 2.2.3 Acceptable manufacturers are Alpha Industries Limited, Flexmaster Ltd., Don-Park, Ecco Manufacturing and United McGill Corp.

### 2.3 DUCT SEALER

- 2.3.1 Hardcast Inc. (Alpha Industries Ltd.), “Iron-Grip,” UL Listed, Class 1 (not exceeding ratings of: flame spread 5; smoke developed 0; fuel contributed 0), water based duct sealer, to ANSI/NFPA 90A -1993, non-flammable wet or dry and flexible when cured.
- 2.3.2 Acceptable manufacturers are Alpha Industries Ltd., Flexmaster Canada Ltd., Dyn Air, Ductmate Canada Limited and Duro-Dyne.

### 2.4 FLEXIBLE CONNECTION MATERIAL

- 2.4.1 Duro-Dyne Ltd., “DUROLON,” UL listed to NFPA 90A, fire resistive, weatherproof flexible vibration isolation fabric material unaffected by sunlight and Ozone, consisting of DuPont “Hypalon” coated woven fibreglass fabric 814 g/sq.m (24 oz/yd.2) mass, 0.63 mm (0.015") thick, suitable for -40°C to 12°C (-40°F to 250°F).
- 2.4.2 Acceptable products are Duro Dyne of Canada Ltd. as above, Ventfabrics Canada Ltd. and Elgen Engineering Ltd.

### 2.5 FUSIBLE LINK FIRE DAMPERS

- 2.5.1 Nailor Industries Inc., ULC 1 1/2 hour rated, listed and labelled galvanized steel folding blade fire dampers as follows:
  - 2.5.1.1 Model No. 0120, Type B, in rectangular ductwork less than 355 mm minimum dimension;
  - 2.5.1.2 Model No. 0110, Type A, in rectangular ductwork 355 mm and larger minimum dimension;
  - 2.5.1.3 Model No. 0130, Type C, in round ductwork.
- 2.5.2 Each fire damper shall be complete with a replaceable 74°C fusible link, and a suitable galvanized steel sleeve.
- 2.5.3 Horizontally mounted fire dampers shall be complete with stainless steel closure springs and positive blade locking devices, and a pull tab arrangement to permit resetting with access from either side of the damper.
- 2.5.4 Fusible link fire dampers required in 3 and 4 hour rated construction shall be generally as specified above but 0500 Series ULC 3 hour rated and labelled.

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2.5.5 Acceptable manufacturers are Nailor Industries Inc., Ruskin Ltd., Greenheck Fan Corp., United Sheet Metal, and NCA Manufacturing Limited.

### 2.6 ROUND TO RECTANGULAR DUCT CONNECTIONS

2.6.1 Alpha Industries Ltd., type “PTR D” galvanized steel spin in connection collars for round to rectangular duct take offs, each with an integral damper. Dampers shall be pivoted by means of two (2) pivot pins.

2.6.2 Acceptable manufacturers are Alpha Industries Ltd., Ductmaster Industries, and NCA Manufacturing Limited.

### 2.7 AIR TURNING VANES

2.7.1 For square duct elbows multiple radius turning vanes, interconnected with bars, adequately reinforced to suit the pressure and velocity of the system, and constructed of the same material as the duct they are associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.7.2 For short branch ducts at grille and diffuser connections air extractor type, each equipped with a matching bottom operated 90° opposed blade volume control damper, constructed of the same material as the duct it is associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

### 2.8 VOLUME (BALANCING) DAMPERS

2.8.1 Nailor Industries Inc., opposed blade volume control dampers, Model No. 1020 for rectangular ductwork, Model No. 1021 for round ductwork, each complete with nylon blade shaft bearings, linkage shaft extension, and a suitable and secure damper operator with locking device and visual indication damper position from the duct exterior, and, unless otherwise noted, constructed of the same material as the ducts they are associated with.

2.8.2 Acceptable manufacturers are Nailor Industries Inc., Greenheck Fan Corp., NCA Manufacturing Limited, Ruskin Ltd., and Air Specialties Manufacturing Ltd.

### 2.9 BACKDRAFT DAMPERS

2.9.1 Nailor Industries Inc., 1300 Series gravity type dampers each complete with a galvanized steel frame, aluminum damper blades with neoprene edges, galvanized steel linkage, and lifetime lubricated nylon bearings.

2.9.2 Acceptable manufacturers are Nailor Industries Inc., Greenheck Fan Corp., NCA Manufacturing Limited, Ruskin Ltd., and Air Specialties Manufacturing Ltd.

### 2.10 MOTORIZED DAMPERS

2.10.1 Dampers for Outdoor and Exhaust Air Applications:

2.10.1.1 Tamco Series 9000 BF low leakage/thermal break thermally insulated air foil damper capable of achieving a 34 l/s/sq. m (6.7 cfm/sq. ft.) at -40°C (-40°F) leakage rate at 4” (1 kPa) differential pressure and bearing the AMCA certification seal for air leakage and complete with:

2.10.1.1.1 2.03 mm (0.080”) thick 100 mm (4”) deep extruded aluminium insulated frame with extruded TPE thermoplastic seals on the sides of the frame. Entire frame shall be thermally broken by means of polyurethane resin pockets, complete with thermal cuts;

2.10.1.1.2 extruded aluminium, broken frame damper blade internally insulated with non-CFC expanded polyurethane foam, with EPDM gasketed blade seals integrally secured to the damper blade;

2.10.1.1.3 acetal copolymer (Celcon) and polycarbonate bearings with no metal-to-metal contact;

2.10.1.1.4 out-of-airstream linkages and crank arms constructed of aluminium and corrosion resistant, zinc & nickel plated steel, complete with cup-point trunnion screws.

2.10.1.2 Dampers shall be sized for “flanged” installation (damper blade area to be equal to duct or plenum cross section area).

2.10.1.3 Acceptable damper manufacturer are Tamco and Nailor.

2.10.2 Control Damper Applications:



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- 2.10.2.1 Automatic control dampers shall be opposed blade type for mixing and parallel blade type for "On off" service.
- 2.10.2.2 Maximum damper blade length shall be 1.2 m (4'). Maximum permissible leakage shall not exceed 1% of the total flow based on an approach velocity of 1500 FPM (7.62 m/s) over a temperature range of from 33°C (30°F) to 38°C (100°F) and a pressure of 3" wg (0.75 kPa). Unless otherwise noted, blades shall be constructed of formed galvanized steel with neoprene seal edges, continuous stops and seals on all sides, oil impregnated bronze bearings, and galvanized steel channel frames.
- 2.10.2.3 Centre bar linkage connectors shall be used wherever possible but where centre bar linkages cannot be used due to space limitations, external side linkage connectors may be used.
- 2.10.2.4 Control dampers in aluminum ductwork or casings shall be as above but constructed of type 316 stainless steel and completely corrosion resistant.
- 2.10.2.5 Acceptable damper manufacturers are Ruskin, National Controlled Air, Nailor Industries and TAMCO.

### **2.11 WALL BOXES**

- 2.11.1 Reversomatic Manufacturing Ltd. single or multiple compartment "Weather-Tight Wall Boxes" with steel housing with single coat epoxy painted interior and double epoxy painted exterior, 150 dia. inlets, a backdraft damper per compartment/section and complete with a single, horizontal blade type extruded aluminium grille with clear anodized finish.
- 2.11.2 Acceptable manufacturers are Reversomatic Manufacturing Ltd., Zonex (Airex), Greenheck Fan Corp., Loren Cook, JennFan, Carnes and Penn Ventilator."

### **2.12 DUCT ACCESS DOORS**

- 2.12.1 In accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible with sizes suitable in all respects for the purpose for which they are provided, and, unless otherwise specified, constructed of the same material as the duct they are associated with.

### **2.13 CASING AND PLENUM MATERIAL**

- 2.13.1 Galvanized (G90) sheet steel with metal gauges in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit the pressure construction standard of the system.

### **2.14 CASING AND PLENUM ACCESS DOORS**

- 2.14.1 Gasketed access doors, factory insulated type in insulated casings or plenums, each constructed of galvanized steel (unless otherwise specified) in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit the pressure classification of the casing or plenum.
- 2.14.2 Access doors shall be minimum 915 mm x 450 mm (36" x 18") but generally 1450 mm x 450 mm (48" x 18") unless casing or plenum panel sizes do not permit, in which case the access doors shall be as large as possible.
- 2.14.3 Where access doors occur in casings and/or plenums constructed of materials other than galvanized steel, the doors shall be as above but constructed of material to match the casing and plenum material.

### **2.15 PLENUM AND CASING BAFFLES**

- 2.15.1 Heavy gauge sheet material to match casing and plenum material, reinforced as required to produce a rigid assembly.

### **2.16 INSTRUMENT TEST PORTS**

- 2.16.1 Duro Dyne of Canada Ltd., No. 1P1 or No. 1P2 or equivalent, (suiting insulation thickness where applicable), gasketed, leak proof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

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### 2.17 ACOUSTIC LINING

- 2.17.1 Johns-Manville, "Linacoustic Permacote HP," 25 mm thick acoustic lining material meeting NFPA 90A and ASTM C1071, G21 and G22 requirements, not supporting microbial growth and flame spread and smoke developed fire hazard ratings of CAN4 S102, consisting of a bonded fibreglass mat coated on the inside (air side) face with a black fire resistant coating.
- 2.17.2 Acceptable manufacturers are Johns-Manville, Fiberglas Canada Ltd., Manson Insulation Inc. and Knauf.

### 2.18 GRILLES AND DIFFUSERS

- 2.18.1 E.H. Price Ltd., of the type, size, capacity, finish and arrangement as shown on the drawings and as per the drawing schedule, each equipped with all required mounting and connection accessories to suit the application.
- 2.18.2 Acceptable manufacturers are E.H. Price Ltd., Titus, Nailor Industries, Tuttle & Bailey, Krueger, Carnes and Metal-Aire.

### 2.19 SILENCERS

- 2.19.1 Vibro-Acoustics silencers per the drawing schedule and as specified hereinafter, each certified to ASTM E477-99 "Standard Method of Testing Duct Liner Materials and Prefabricated Silencers For Acoustical and Airflow Performance" completely prefabricated and as follows:
- 2.19.1.1 Materials
- 2.19.1.1.1 Type RD rectangular type silencers shall be constructed with a 22 gauge (0.78 mm) galvanized steel outer casing and 26 gauge (0.47 mm) galvanized perforated steel.
- 2.19.1.1.2 Type RED elbow silencers shall be constructed with an 18 gauge (1.24 mm) galvanized steel outer casing and 22 gauge (0.78 mm) galvanized perforated steel. All acoustical splitters shall be internally radiused and aerodynamically designed for efficient turning of the air. Half and full splitters are required as necessary to achieve the scheduled insertion loss. All elbow silencers with a turning cross-section dimension greater than 48" (1200 mm) shall have at least two half splitters and one full splitter.
- 2.19.1.2 Acoustic Media:
- 2.19.1.2.1 Media for type RD and RED MoldBlock Media™ silencers shall be Vibro-Acoustics® MoldBlock Media™ containing 100% natural cotton fibers treated with an EPA registered, non-toxic borate solution "flash dried" to provide resistance to mold, mildew and fungi. Media shall comply with UL181 and NFPA 90A. MoldBlock Media™ shall be packed with a minimum of 15% compression during silencer assembly. Media shall not cause or accelerate corrosion of aluminum or steel.
- 2.19.1.3 Acoustic Media Protection
- 2.19.1.3.1 Type RD and RED silencers shall be as above with acoustic media completely wrapped with Tedlar film to prevent shedding, erosion and impregnation of glass fibre. The wrapped acoustic media shall be separated from the perforated metal by a factory installed 12 mm (1/2") thick acoustically transparent spacer. The spacer shall be flame retardant and erosion resistant. A mesh, screen or corrugated liner will not be acceptable as a substitute for the specified spacer.
- 2.19.1.4 HTL Casings
- 2.19.1.4.1 Where indicated on the silencer schedule, silencers shall have a high transmission loss (HTL) walls externally applied and completely sealed to the silencer casing by the silencer manufacturer to assure quality controlled transmission loss. The HTL walls shall consist of media, airspace, mass and outer protective metal skin, as required to obtain the specified room noise criteria. Standard acoustical panels will not be accepted as HTL walls. Provide breakout noise calculations as part of the silencer shop drawing submissions for each air handling and fan system with HTL silencers. Breakout noise shall be based on the sound power levels of the specified equipment.
- 2.19.1.4.2 Manufacturer shall certify on shop drawings that silencer performance is per ASTM E477-99. Shop drawings submitted without same, will be rejected.
- 2.19.1.4.3 Provide a complete submittal package containing the following information:

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- 2.19.1.4.3.1 Shop drawings detailing all silencer data specified in the schedule. The data shall match the project's system requirements for volume and direction of airflow.
- 2.19.1.4.3.2 Submittals shall include certified test data on dynamic insertion loss, self-noise power levels, and pressure drop for reverse or forward flow. Silencer performance must have been substantiated by laboratory testing according to ASTM E477-99 and so certified when submitted for approval. The aero-acoustic laboratory must be NVLAP accredited for the ASTM E477-99 test standard. A copy of the accreditation certificate must be included with the submittals. Data from non-NVLAP accredited test facilities will not be accepted. Shop drawings submitted without proper certifications will be rejected.
- 2.19.1.4.3.3 Submittals shall include Material Safety Data Sheets provided by the manufacturer for all acoustic media, Tedlar film liner and acoustical spacer materials.
- 2.19.1.4.3.4 Submittals shall include Transmission Loss (TL) data for casings of all silencers with HTL casings in accordance with paragraph 2.20.1.4 above and Table below.

| Transmission Loss Data Table   |       |        |        |        |
|--|-------|--------|--------|--------|
| Material   | 63 Hz | 125 Hz | 250 Hz | 500 Hz |
| 16 (1.6) - 2.7 (12.96)   | 26    | 29     | 32     | 35     |
| 14 (1.99) - 3.3 (16.01)  | 29    | 32     | 35     | 38     |
| 12 (2.75) - 4.5 (22.11)  | 31    | 34     | 37     | 40     |
| 8 (4.27) - 6.9(33.13)  | 35    | 38     | 41     | 44     |
| Material indicates gauge (thickness in millimetres) - weight in pounds/square foot (Kg/square metre) |       |        |        |        |

- 2.19.1.4.4 Acceptable manufacturers are Vibro-Acoustics, J.P. Environmental Products Inc. and Vibron.

### 2.20 FLUES AND STACKS

- 2.20.1 ULC listed and labelled type "B", sectional, prefabricated, double wall gas vent, 425°C rated with prefabricated mated fittings, couplings and accessories including a flashing accessory, storm collar counter-flashing piece, and a termination cap approved by Governing Authorities.
- 2.20.2 Metal Fab Inc. "Corr/Guard" model CG, double wall, ULC listed, positive pressure vent factory built for use with condensing appliances or Category IV appliances as specified by the equipment manufacturer, rated for 288°C (550°F) constructed with an inner and outer wall with an 1" annular air space. The inner wall shall be constructed of AL29-4C, superferritic stainless steel, with a minimum thickness of 28 gauge (0.38 mm). The outer wall shall be constructed of type 304 stainless steel, with a minimum thickness of 26 gauge (0.46 m). The inner and outer wall shall be connected by means of spacer clips that maintain the concentricity of the annular space and allow for differential thermal expansion of the inner and outer walls. All vent components that are directly exposed to the outdoors shall be stainless steel. Where exposed to weather, casing joints shall be sealed to prevent leakage of water into annular space between the inner and outer walls. Vent system shall come complete with all required accessories required to install vent including but not limited to roof or wall penetrations (as required), terminations, appliance connectors and drain fittings. All roof penetration components shall be ULC listed.
- 2.20.3 Acceptable manufacturers are as follows:
- 2.20.3.1 Type B vent - Acceptable manufacturers are Industrial Chimney Company Inc., Selkirk-Metalbestos, Metal-Fab and Van Packer.
- 2.20.3.2 Type BH vent - Metal Fab or equal. Alternate manufacturers of vent must specify in their shop drawing submittals that proposed vent is ULC listed and is built for use with condensing appliances or Category IV appliances.

### 2.21 VIBRATION ISOLATION

- 1.1 WORK INCLUDED

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A. This section provides minimum acceptance requirements for vibration isolation and seismic restraints for all heating, ventilating, and air-conditioning equipment, ductwork and piping.

B. See schedules on drawings for specific requirements for equipment.

### 1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete work is provided in Division 03.

B. Concrete Floating Floors are specified in Division 13.

C. Vibration isolation for plumbing systems are provided in Division 22.

D. Ductwork flexible connections are specified elsewhere in Division 23.

E. Vibration isolation for electrical systems are provided in Division 26.

### 1.3 QUALITY ASSURANCE

A. Unless otherwise directed by the local authority having jurisdiction, the following codes and standards will apply:

1. International Building Code 2009
2. American Society of Civil Engineers 7-05
3. [Local State Building Code]
4. [Local Municipal Building Code]

### 1.4 SUBMITTALS

A. All vibration isolation systems shall be by one manufacturer. Preferred manufacturer is Vibro-Acoustics.

B. Submit shop drawings for all devices specified herein and as indicated and scheduled on the drawings. Submittals shall indicate full compliance with the device specification in Part 2. Any deviation shall be specifically noted and subject to engineer approval. Submittals shall include device dimensions, placement, attachment and anchorage requirements.

### 2.1 VIBRATION ISOLATION:

A. Springs: All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability. Laterally stable springs shall have  $k_x/k_y$  ratios of at least 0.9. All springs shall be fully color-coded to indicate capacity – color striping is not considered adequate.

B. Corrosion Protection: All springs shall be powder-coated enamel. Housings shall be galvanized, powder-coated enamel, or painted with rust-resistant paint. Hot-dipped galvanized housings shall be provided as indicated on the Schedule.

C. Steel Equipment Base: Bases shall be of welded construction with cross members to form an integral support platform. Structural steel members shall be designed to match supported equipment.

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1. Vibration bases for fans shall have adjustable motor slide rails as indicated on the Schedule, and shall accommodate motor overhang.
  2. Bases for exterior use shall be painted or hot-dipped galvanized for complete corrosion resistance.
  3. Minimum clearance under steel equipment bases shall be 25mm (1”).
- D. Concrete Inertia Base: Inertia bases shall be of welded steel construction with concrete in-fill supplied by the installing contractor on site and shall incorporate 15M (No.4) reinforcing bars, welded 300 mm (12”) maximum on centers each way.
1. Inertia bases for pumps shall be of sufficient size to accommodate supports for pipe elbows at pump suction and discharge connections.
  2. Inertia bases for fans shall include motor slide rails as indicated on the Schedule.
  3. The weight of each inertia base shall be at least equal to the weight of the equipment mounted thereon or sufficient to lower the center of gravity to or below the isolator support plane.
  4. Inertia bases shall be a minimum of 100 mm (4”) thick. (See Isolation Schedule).
  5. Height-saving brackets or welded steel pockets shall be incorporated to ensure a 50 mm (2”) minimum clearance under each inertia base.
- E. Isolators:
1. Free Spring Floor Mounted Isolators: Type FS – Free-standing, laterally stable, unhooused spring isolators with components for leveling and securing equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 6 mm (0.25”) thick, bonded to the base plate. Type FST – same as Type FS with the addition of an equipment support top plate.
  2. Restrained Spring Floor Mounted Isolators: Type CSR – Laterally stable, vertically restrained spring isolators with welded steel housings and heavy top plates for supporting equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 6 mm (0.25”) thick, bonded to the base plate. Housings shall include vertically restraining limit stops. Minimum clearance around the restraining bolts and between the housing and the spring shall be 13 mm (0.5”). Top plate and restraining bolts shall be out of contact with the housing during normal operation and neoprene grommets shall be incorporated to minimize short-circuiting of restraining bolts.
  3. Closed Mount Spring Isolators: Type CM – Floor mounted spring isolators with telescoping housings and bolts for leveling and securing equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a neoprene noise isolation pad, minimum 6 mm (0.25”) thick, bonded to the base plate. Housings shall be fabricated or welded steel telescoping housings that incorporate neoprene stabilizers to minimize short circuiting and provide vertical damping.
  4. Rubber-in-Shear Floor Mounts: Type RD – “Double-deflection” neoprene isolators, with neoprene-coated metal surfaces, and top and bottom surfaces ribbed. Isolators shall have bolt holes in the base.
  5. Spring Hangers: Vibration isolator hanger supports with steel springs and welded steel housings. Hangers shall be designed for a minimum of 15 degree angular misalignment from vertical before support rod contacts housing; hangers serving lightweight loads 0.90

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kN (200 lbs) and less may be exempt from this requirement. Provide a vertical uplift stopwasher on spring hangers for seismically restrained equipment, duct or piping.

- a. Type SH – spring hanger isolators complete with spring, compression cup, and neoprene acoustic washer.
  - b. Type SHR – spring hanger with neoprene isolators complete with spring, compression cup, and neoprene “double-deflection” element at top of hanger.
  - c. Type SHB – spring hanger with bottom cup isolators complete with spring, compression cup, and neoprene cup under spring.
  - d. Type SHRB – spring hanger with neoprene and bottom cup isolators complete with spring, compression cup, neoprene “double-deflection” element at top of hanger, and neoprene cup under the spring.
  - e. Type PSH – precompressed spring hanger isolators complete with spring, compression cup, neoprene acoustic washer, and hardware to compress spring. Springs shall be precompressed to 2/3 rated load.
  - f. Type PSHR – precompressed spring hanger with neoprene isolators complete with spring, compression cup, neoprene “double-deflection” element at top of hanger, and hardware to compress spring. Springs shall be precompressed to 2/3 rated load.
  - g. Type PSHB – precompressed spring hanger with bottom cup isolators complete with spring, compression cup, neoprene cup under spring, and hardware to compress spring. Springs shall be precompressed to 2/3 rated load.
  - h. Type PSHRB – precompressed spring hanger with neoprene and bottom cup isolators complete with spring, compression cup, neoprene “double-deflection” element at top of hanger, neoprene cup under the spring, and hardware to compress spring. Springs shall be precompressed to 2/3 rated load.
6. Neoprene Hangers: Type NH – “Double-deflection” neoprene hanger isolators, each with an integral neoprene sleeve between hanger rod and housing. The neoprene element shall include an internal metal washer as a fail safe to prevent pull-out failure. Provide vertical uplift stopwasher on neoprene hangers for seismically restrained equipment, duct or piping.
  7. Vibration Isolation Pads: Type N – Neoprene pad type isolators, 10 mm (0.375") minimum thick, ribbed on both sides. Type NSN – Sandwich neoprene pad type isolators, with 10 mm (0.375") minimum thick ribbed neoprene pads bonded to each side of a 3.5 mm (10 ga) minimum galvanized metal plate. Isolator pads shall be selected to ensure that deflection does not exceed 20% of isolator free height.
  8. Curb-mounted Spring Rails: Type RTR – Full-perimeter rail type isolators, minimum 1.6 mm (16ga) formed galvanized steel construction with integral spring isolators designed to fit over roof curbs and under isolated equipment. Wind resistance shall be provided by means of resilient snubbers with a minimum clearance of 6 mm (0.25") so as not to interfere with the spring action except in high winds. Weather seals shall consist of continuous closed cell sponge material both above and below the rail and waterproof, flexible EPDM connections joining the outside perimeter of the upper and lower members. Rails shall be manufactured, shipped and installed as single pieces unless the size exceeds standard shipping dimensions. Shipping splits and lifting points shall be coordinated with the installing contractor. Optional acoustic barrier systems shall be provided as scheduled.
  9. Spring Isolation Roof Curbs: Type VCR – Curb type isolators with integral spring isolators, designed to provide complete roof curb installations. Curbs shall be designed to bear directly on and attach directly to the roof structure with provisions for accommodating roof

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slope and maintaining equipment level. The lower portion of an isolation curb shall be constructed with minimum 1.3 mm (18ga) galvanized steel with a full-perimeter factory-attached 2x4 wood nailer. The upper frame shall provide continuous support for the equipment and shall resiliently withstand wind and seismic forces. The minimum height of a curb shall be 380 mm (15”) from the roof structure to the top of the nailer. Weather seals shall consist of continuous closed cell sponge material on top of the curbs and waterproof, flexible EPDM connections joining the outside perimeter of the upper and lower members. Galvanized steel duct supports and flexible connections shall be provided as required. Curbs shall be manufactured, shipped and installed as single pieces unless the size exceeds standard shipping dimensions. Shipping splits and lifting points shall be coordinated with the installing contractor. Optional acoustic barrier systems shall be provided as scheduled.

10. Acoustic Barrier Systems: provide as scheduled to ensure a noise criteria of NC\_\_\_ in the adjacent spaces below. Provide duct silencers, absorptive lining, and high-transmission loss panels as required to meet background noise criteria. Manufacturer shall guarantee acoustic performance.

a. High-transmission loss panel assemblies shall consist of 50 mm (2”) minimum thickness panels installed as low as possible in the curbs. The panels shall be constructed using 1.3 mm (18ga) minimum galvanized solid steel and acoustic grade fiberglass insulation.

b. The panel assemblies shall provide the minimum following performance:

|                        |    |     |     |     |      |      |      |
|------------------------|----|-----|-----|-----|------|------|------|
| Octave band (Hz)       | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 |
| 8000                   |    |     |     |     |      |      |      |
| Transmission Loss (dB) | 16 | 21  | 27  | 37  | 48   | 54   | 54   |
| 54                     |    |     |     |     |      |      |      |

c. Any absorptive panels used in Acoustic Barrier Systems shall have a minimum sound absorption coefficient performance of:

|                        |     |     |     |      |      |      |
|------------------------|-----|-----|-----|------|------|------|
| Octave band (Hz)       | 125 | 250 | 500 | 1000 | 2000 | 4000 |
| Absorption Coefficient | 0.3 | 0.7 | 0.9 | 0.99 | 0.9  | 0.8  |

d. A barrier system shall include both supply and return air silencers as required and as scheduled on the silencer schedule.

11. Flexible connectors - Piping: Twin-sphere type, made of nylon cord fabric and neoprene or EPDM rubber as required for service. Connectors shall be line size and shall be designed for the pressures and temperatures encountered in the system, minimum 6.83 MPa (115 psig) and 52° C (125° F).

**3.1 GENERAL:**

- A. Coordinate size, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint device manufacturer to ensure adequate space and prevent edge breakout failures. Pads and piers must be adequately doweled in to structural slab.
- B. Coordinate locations and sizes of structural supports with locations of vibration isolators and seismic/wind restraints (e.g., roof curbs, cooling towers, air-cooled chillers, etc.).
- C. Isolated and restrained equipment, duct and piping located on roofs must be attached to the structure. Supports (e.g., sleepers) that are not attached to the structure will not be acceptable.

**3.2 VIBRATION ISOLATION:**

- A. Block and shim all bases level so that all ductwork, piping and electrical connections can be made to a rigid system at the proper operating level, before isolators are adjusted. Ensure that there are

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no rigid connections or incidental physical contacts between isolated equipment and the building structure or nearby systems.

- B. Ensure housekeeping pads have adequate space to mount equipment and isolator housings and shall also be large enough to ensure adequate edge distance for isolator anchors.
- C. Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.
- D. Mount fans, as indicated on the Drawings, on structural steel vibration bases common to both fan and motor. There shall be a minimum operating clearance of 25 mm (1") between steel bases and the structure.
- E. Mount pumps and equipment, as indicated on the Drawings, on concrete-filled inertia bases. Concrete in-fill shall be supplied by the installing contractor on site. There shall be a minimum operating clearance of 2" 50 mm between each inertia base and its foundation.
- F. Extent of Piping Isolation:

- 1. Isolate all piping larger than 25 mm (1") dia. rigidly connected to vibration isolated equipment with 25 mm (1") static deflection spring hangers at spacing intervals in accordance with the following:

| <u>Pipe Diameter</u> | <u>Distance from Vibrating Equipment</u> |
|----------------------|--|
| 2" to 4"             | 50'                                      |
| 6" and 8"            | 60'                                      |
| 10" and larger       | 70'                                      |

| <u>Pipe Diameter</u> | <u>Distance from Vibrating Equipment</u> |
|----------------------|--|
| 50 mm to 100 mm      | 15 m                                     |
| 150 mm and 200 mm    | 18 m                                     |
| 250 mm and larger    | 21 m                                     |

- a. Chilled, Condenser, and Domestic Cold and Hot Water Piping:

- 1) Horizontal: Pipe stand floor supports shall be supported on Type CSR isolators. Suspended piping shall be supported with Type SHR isolators. The first 3 isolators shall have the same minimum static deflection as the equipment isolators, with a maximum of 50 mm (2"). The remaining isolators shall have a minimum 25 mm (1") static deflection.
  - 2) Vertical: Piping shall be isolated from the supporting members or structure with Type FS or SHR isolators with a minimum 25 mm (1") static deflection.
- 2. Spring hanger isolators shall be cut in to the hanger rods and installed after the system is filled. Alternatively, provisions must be made to ensure piping does not change height during installation and start-up.
  - 3. Piping attached to isolated equipment with flexible connections or to air handling units with internal vibration isolators meeting the requirements of these specifications is exempt from these requirements.

- G. Extent of Ductwork Isolation:

- 1. Provide isolation for ductwork as indicated on the drawings.



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- a. Suspended ductwork shall be supported with Type SHR isolators with a minimum 25 mm (1") static deflection.
  - b. Floor-supported ductwork shall be isolated from the structure with Type FS isolators with minimum 25 mm (1") static deflection.
2. Grease hood exhaust ductwork shall be isolated as follows:
- a. Distance from fan inlet: 15 m (50').
  - b. Distance from fan discharge: 15 m (50').
- H. Engine-generator set silencers and associated exhaust piping shall be supported with Type SHR isolators with a minimum 40 mm (1.5") static deflection.
- I. There shall be no rigid contact of isolated piping, ductwork, or equipment with shaft walls, floor slabs, partitions, or conduits.
- J. Provide height-saving brackets where recommended by the manufacturer for equipment stability, or operating height requirements.
- K. Where recommended by the manufacturer, isolator base plates shall be bolted to the structure or foundation. Bolting shall incorporate neoprene bushings and washers.
- L. Provide spring-loaded thrust restraints for fans and air handling units where movement under any operating condition will exceed 10 mm. (0.375"). Isolator hangers shall be installed with the housing a minimum of 6 mm (1/4") below but as close to the structure as possible. Where isolator hangers would be concealed by non-accessible acoustical sub ceiling, install the hangers immediately below the sub ceiling for access.
- 3.3 INSPECTION AND CERTIFICATION:
- A. After installation, arrange and pay for the vibration isolation product manufacturer to visit the site to verify that the vibration isolation systems are installed and operating properly, and shall submit a certificate so stating. Verify that isolators are adjusted, with springs perpendicular to bases or housing, adjustment bolts are tightened up on equipment mountings, and hangers are not cocked.

**PART 3 - EXECUTION**

**3.1 GENERAL RE: FABRICATION AND INSTALLATION OF DUCTWORK**

1. Construct ductwork so that manufacturer's gauge markings are external, and, unless otherwise specified, construct, seal and install ductwork in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct pressure class designation. Sealing for ductwork with a pressure class less than 0.45 kPa shall be SMACNA Seal Class "C."
2. Ductwork leakage shall not exceed the following:
  - a. ductwork to 2" W.C. Class – 1% of the total air quantity handled by the respective fans;
  - b. ductwork exceeding 2" W.C. Class – 2% of the total air quantity handled by the respective fans.
3. Leakage testing shall be provided by the Testing, Adjustment and Balancing (TAB) Agency, in accordance with requirements of Section 15890. Be responsible for the following:
  - a. preparing ductwork 7.5 m (25') and longer, for leakage testing prior to installation of external insulation including capping duct runouts and provision of tap-in for test equipment;
  - b. schedule testing with TAB Agency, in advance, and ensuring notice is given to Consultant so that they may witness testing. Be present for all testing;
  - c. resealing and/or replacement of defective ductwork;
  - d. bearing all costs associated with retesting ductwork which has failed to pass leakage testing.
4. Provide automatic control dampers, except for dampers supplied as part of the cabinet fan assemblies.
5. Ensure that control dampers located in aluminium ductwork are constructed of type 316 stainless steel and are non-corrosive.
6. Where watertight horizontal ductwork is required inside the building, construct the ducts without bottom longitudinal seams. Solder or weld the joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide watertight ductwork for:
  - a. outdoor air intakes;
  - b. wherever else shown.

**3.2 FABRICATION AND INSTALLATION OF GALVANIZED STEEL DUCTWORK**

- 3.2.1 Provide all required galvanized steel ductwork. Unless otherwise noted, construct all ductwork of galvanized sheet steel, round, oval, or rectangular as shown and/or required.
- 3.2.2 Round or oval ductwork and fittings shall be factory made and joints shall be slip type secured with properly sized sheet metal screws.
- 3.2.3 Factory made flanged joint system components are acceptable in rectangular duct installations. Install the components in strict accordance with the manufacturer's printed instructions and recommendations.

- 3.2.4 Seal ductwork using duct sealer reinforced with embedded tape where required, in accordance with sealant manufacturer's instructions and requirements of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL."

**3.3 FABRICATION AND INSTALLATION OF ALUMINIUM DUCTWORK**

- .1 Provide sheet aluminium ductwork for all ductwork as shown on the drawings and specified herein.
- .2 Wherever bare aluminium ductwork comes in contact with ferrous metal or copper, paint the ferrous metal or copper surface with a heavy 100% covering coat of zinc chromate paint, asphalt paint or otherwise isolate direct contact with the bare aluminium.
- .3 Slope branch aluminium ductwork down to mains and/or the riser wherever possible. Provide an aluminium drain plug in the bottom of the riser, and at all other low points. Where it is not possible to slope aluminium branch ductwork down to mains or risers, slope the ductwork down to exhaust grilles.
- .4 Seal all joints to Seal Class "A" requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible using ULC listed sealer.

- 3.2.5 Do not use drive and S cleats for water-proof ductwork. Use the following SMACNA joining methods:

- 3.2.5.1 T-21 - welded flange;

- 3.2.5.2 T-22 - companion angle and gasket;

- 3.2.5.3 T-23 - flanged.

- 3.2.6 Keep longitudinal joints at the top surface of horizontal runs. Provide proper transverse supports to prevent deflection of ductwork. Ensure that the duct is rigid.

- 3.2.7 When mastic is used for sealing such as sealing longitudinal joints, apply the mastic to both surfaces before they are mated. When dry, apply mastic again for a water-tight seal.

- 3.2.8 Aluminium ductwork shall be specified for the following systems:

- 3.2.8.1 all branch shower exhaust ductwork from the exhaust grille to the point of connection between the branch exhaust duct and the main;

- 3.2.8.2 wherever else shown on drawings.

**3.4 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL**

- .1 Provide a minimum of 150 mm (6") of flexible connection material where ducts, plenums and/or casings connect to fans, and wherever else indicated.
- .2 Install flexible connection material in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

**3.5 INSTALLATION OF SPLITTER DAMPERS**

- .1 Provide splitter dampers in supply ductwork at branch duct connections to supply air mains, and wherever else shown and/or specified on the drawings, or required for proper air distribution and air quantity balancing. Install splitter dampers such that they cannot vibrate and rattle and such that the damper operation mechanisms are in an easily operable location.

**3.6 INSTALLATION OF TURNING VANES**

- .1 Provide turning vanes in ductwork elbows where shown on the drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

**3.7 INSTALLATION OF FUSIBLE LINK FIRE DAMPERS**

- .1 Provide fusible link fire dampers where shown on the drawings. Ensure that each fire damper is suitable for the fire rating of the fire barrier it is associated with.
- .2 Supply dampers which are factory secured within a galvanized steel sleeve, or supply the sleeves and install at the site. Install the dampers by means of No. 14 gauge, 20 mm (3/4") sheet metal screws at 6" (150 mm) OC.
- .3 Secure 38 mm x 38 mm x 3 mm (1-1/2" x 1-1/2" x 1/8") black steel angles by means of tack welding or bolts to the perimeter of one (1) side of the damper sleeves. Install the sleeves in the opening, then secure angles to the perimeter of the sleeve at the opposite side of the barrier penetrated by the duct.
- .4 Provide expansion clearances between the damper sleeve and the opening in which the damper is required. Ensure that the openings are properly sized and located, and that all voids between the damper sleeve and the opening are properly sealed to maintain the rating of the fire barrier.
- .5 Connect and secure ductwork to fire dampers in accordance with the damper manufacturer's recommendations and to NFPA requirements.
- .6 Where sectionalized fire damper assemblies are required in large ducts or wall openings, provide multiple fusible link dampers bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized.
- .7 When fire damper installations have been completed, an inspections team will inspect each and every fire damper installation to ensure that the dampers have been installed properly, that the connecting ductwork, if applicable, is attached properly, and that the space between the wall or slab opening and the damper sleeve has been sealed properly to maintain the fire rating of the fire barrier. Be responsible for:
  - 3.2.8.3 inspecting fire damper installations yourself prior to official inspection to ensure that the dampers are installed properly and that ductwork is connected properly;
  - 3.2.8.4 being present during all official inspection tours;
  - 3.2.8.5 all fire damper corrective work resulting from inspections.

**3.8 INSTALLATION OF BACKDRAFT DAMPERS**

- .1 Provide backdraft dampers where shown.
- .2 Install and secure such that the dampers cannot move or rattle.

**3.9 INSTALLATION OF MOTORIZED DAMPERS**

- .1 Provide all dampers except for recirc. dampers inside of air handling units.
  - 3.2.9 Where a duct for which a motorized damper is required has dimensions larger than the dimensions of the maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly or bolted to a heavy gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by pass, and provide connecting linkage.
  - 3.2.10 Where possible, locate dampers not to exceed 3.6 m A.F.F.

**3.10 INSTALLATION OF WALL BOXES**

- .1 Supply wall boxes as shown on the drawings. Hand over boxes to the masonry trade on site for installation and flashing into the wall construction as part of the masonry work."

**3.11 INSTALLATION OF VOLUME (BALANCING) DAMPERS**

## SECTION 15880 – AIR DISTRIBUTION

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- .1 Provide volume type dampers in all open end ductwork, in all supply and return air duct mains, and wherever else shown and/or specified. Install balancing dampers in open end ductwork a minimum of 1 m downstream of opening, to ensure accurate measurement during TAB work.
  - 3.2.11 Install the dampers such that the operating mechanism is positioned for easy operation, and that the dampers cannot move or rattle.
  - 3.2.12 Where a duct for which a volume damper is required has dimensions larger than the dimensions of the maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.
  - 3.2.13 Confirm exact volume damper locations with personnel doing air quality balancing and testing work and install dampers to suit.

### 3.12 INSTALLATION OF DUCT ACCESS DOORS

- .1 Provide access doors in ductwork for access to all duct system components which will or may need maintenance and/or repair, including booster heating coils. Install in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.
  - 3.2.14 Identify access doors provided for fusible link damper maintenance with “FLD” painted or marker type red lettering and ensure that the doors are properly located for damper maintenance.
  - 3.2.15 When requested, submit a sample of proposed duct access doors for approval.
  - 3.2.16 Where sectionalized fusible link dampers are provided in large ducts, provide multiple access doors to suit and adequately reinforce the ductwork to suit the number of access doors installed.

### 3.13 FABRICATION AND INSTALLATION OF CASINGS AND PLENUMS

- .1 Provide all required casings and plenums. Construct casings and plenums of the same material as the connecting duct system, unless otherwise noted.
  - 3.2.17 All sheet metal work, whether workshop or site fabricated, for housing fans and equipment and all air passage barriers connected to building surfaces shall be considered casings and/or plenums.
  - 3.2.18 Construct and install casings and plenums in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the systems static pressure and velocity. Ensure that plenums and casings secured to building structure are gasketed air-tight and equipped with angle iron reinforcing.
  - 3.2.19 Provide all required access doors in casings and plenums. Access doors shall be constructed of the same materials as the casing or plenum. Install in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

### 3.14 INSTALLATION OF CASING AND PLENUM BAFFLES

- .1 Provide reinforced baffles in casings and plenums wherever required to prevent stratification or other air movement or mixing problems.
  - 3.2.20 Construct baffles of the same material as the casing or plenum.
  - 3.2.21 Exactly locate and arrange baffles as per directions of personnel performing system testing and balancing work.

### 3.15 INSTALLATION OF INSTRUMENT TEST PORTS

- .1 Provide instrument test ports in all main ducts at connections to fans, plenums or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing of the systems.

- 3.2.22 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

**3.16 INSTALLATION OF ACOUSTIC LINING**

- .1 Provide acoustic lining to the extent shown and/or specified on the drawings.
  - 3.2.23 Install lining in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

**3.17 INSTALLATION OF SILENCERS**

- .1 Provide silencers where shown and as scheduled on the drawings.
  - 3.2.24 Secure and support each silencer rigidly in place, independent of the ductwork or casings connected thereto.
  - 3.2.25 Where silencers penetrate partition walls, seal the joint between the perimeter of the silencer and the wall, on both sides of the wall, with proper acoustic caulking.

**3.18 INSTALLATION OF GRILLES AND DIFFUSERS**

- .1 Provide grilles and diffusers where shown on the drawings. Wherever possible, grilles and diffusers shall be the product of one (1) manufacturer. Unless otherwise specified, connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.
  - 3.2.26 Exactly locate grilles and diffusers to conform to the final architectural reflected ceiling plans and detailed wall elevations, and to conform to the final lighting arrangement, ceiling layout, ornamental and other wall treatment.
  - 3.2.27 Equip supply diffusers having a basic 4-way or all round air pattern for operation in one (1), two (2) or three (3) way pattern where so directed on the drawings.
  - 3.2.28 Confirm grille and diffuser finishes prior to ordering.

**3.19 INSTALLATION OF FLUES AND STACKS**

- .1 Provide ULC listed and labelled flues and stacks for equipment as shown.
  - 3.2.29 Provide the appropriate flue and stack for gas fired equipment. Coordinate the supply of the equipment with the manufacturer of gas fired equipment to ensure that the appropriate flue or stack is provided. It is the contractor's responsibility to provide the appropriate flue or stack for the intended application and in compliance with all codes. Failure to provide the appropriate flue and stack shall result in the removal of the flue and stack and replacement with appropriate flue and stack at no extra cost to the contract.
  - 3.2.30 Install components in strict accordance with manufacturer's published instructions and recommendations.
  - 3.2.31 Secure horizontal flue sections in place by means of steel band hoops conforming to the flue diameter and hanger rods attached to the top of the hoop and the structure. Support spacing shall be in accordance with the flue manufacturer's recommendations.
  - 3.2.32 Support vertical stack sections inside the building at the roof level and wherever else required by means of purpose made vertical support accessories supplied by the manufacturer.
  - 3.2.33 Provide stack flashing collars, install and flash into roof construction. Install counter flashing pieces over the collars.
  - 3.2.34 Equip the termination of each stack with a rain cap. Confirm the height requirement for the stacks above the roof with the Governing Authorities prior to installation.

## **SECTION 15880 – AIR DISTRIBUTION**

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- 3.2.35 Provide flanges at boiler flue outlet to allow for removal of boiler without disturbing flues and stacks.
- 3.2.36 Confirm flue and stack diameter(s) prior to ordering.

### **3.20 TESTING, ADJUSTING AND BALANCING**

- .1 Testing, adjusting and balancing of air distribution work shall be performed by an independent third party balancing contractor and shall be included in the mechanical contracts.
  - 3.2.37 The mechanical contractor shall cooperate with the balancing contractor and provide whatever assistance the balancing contractor may require in order to complete the work.
  - 3.2.38 Prepare the systems for balancing as follows:
    - 3.2.38.1 check the operation of fan equipment, automatic dampers, and similar air flow control devices and ensure that they are operating properly;
    - 3.2.38.2 ensure that air filters are new and clean;
    - 3.2.38.3 ensure that any required duct leakage testing has been completed and that the duct systems are air-tight within tolerances specified in this Section.
  - 3.2.39 Perform all corrective work such as fan sheave replacement and duct sealing recommended by the Balancing Personnel.

**END OF SECTION 15880**

## **SECTION 15890 – TESTING, ADJUSTING AND BALANCING**

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## **SECTION 15890 – TESTING, ADJUSTING AND BALANCING**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 Section 15010 this Division of the Specification applies to and is a part of this Section of the Specification.

#### **1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 The following work which is related to the testing, adjusting and balancing work is specified in other Sections of the Specification:
  - .1 provision of heat transfer equipment, testing and balancing devices in heat transfer piping, and preparation of systems for balancing;
  - .2 provision of balancing devices in duct systems, and preparation of systems for balancing;
  - .3 provision of air handling equipment, and replacement of fan sheaves for fan speed adjustment;
  - .4 testing of automatic control systems and setting of all control system motorized dampers, valves, thermostats, and similar items.

#### **1.3 QUALITY ASSURANCE**

- .1 Testing, adjusting and balancing work shall be performed by a specialist company who is a member in good standing of the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).

#### **1.4 SUBMITTALS**

- .1 Submit five (5) copies of the completed testing and balancing report to the Consultant for review. If, after verification spot checks, the Consultant rejects the report, submit five (5) copies of a new report outlining results of rebalancing procedures. Unless otherwise specified, repeat until report data is verified to be substantially the same as spot check readings.

### **PART 2 - PRODUCTS**

#### **2.1 NIL**

### **PART 3 - EXECUTION**

#### **3.1 SITE VISITS DURING CONSTRUCTION**

- .1 After careful review of the mechanical work drawings and specifications, the testing and balancing agency shall visit the site at frequent, regular intervals during construction of the mechanical systems to observe routing of services, locations of testing and balancing devices, workmanship, and anything else which will affect testing, adjusting and balancing.
- .2 After each site visit, the agency shall report results of the site visit to the Consultant, in writing, with a copy to the Project Manager, indicating the date and time of the visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing.

#### **3.2 TESTING, ADJUSTING AND BALANCING WORK**

- .1 Testing, adjusting and balancing work, as specified herein, shall be performed for the following:
  - .1 domestic hot water circulation system(s);
  - .2 new supply, return and exhaust air handling systems.
- .2 Test, adjust and balance the complete mechanical systems over the entire operating range of each system in accordance with the most stringent requirements of the AABC National Standards for Total System Balance or NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, as applicable, in order to obtain optimum systems performance.

## SECTION 15890 – TESTING, ADJUSTING AND BALANCING

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- .3 Do not begin testing, adjusting and balancing work until:
  - .1 building construction work is substantially complete;
  - .2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then performance tested in the presence of and to the satisfaction of the Consultant;
  - .3 the mechanical systems have been prepared for testing and balancing work, as specified in Sections 15700 and 15880.
- .4 All mechanical systems to be tested, adjusted and balanced must be maintained in full, normal operation during each day of testing, adjusting and balancing.
- .5 Balance all systems with due regard to objectionable noise which shall be a factor when adjusting fan speeds and performing terminal work such as adjusting grille and diffuser air quantities. Should objectionable noise occur at design conditions, immediately report the problem to the Consultant and submit data, including sound readings, to permit the Consultant to make an accurate assessment of the noise problem.
- .6 Check all air handling system mixing plenums for stratification, and where the variation of mixed air temperature across coils is found to be in excess of plus or minus 5% of design requirements, report to the Consultant and issue a detail sketch of plenum baffle(s) required to eliminate the stratification. Provide the baffles in accordance with the reviewed sketches.
- .7 Perform testing, adjusting and balancing to within plus or minus 5% of design values, and make and record measurements using instruments with minimum accuracy of within plus or minus 2% of required values.
- .8 Wherever possible, lock all balancing devices in place at the proper setting, and permanently mark settings on all devices.
- .9 Leak test ductwork in accordance with the requirements of SMACNA "HVAC Air Duct Leak Test Manual." Coordinate your work with the work of Section 15880. Provide detailed sketch(es) identifying ductwork not in accordance with acceptable leakage values specified in Section 15880. Forward sketches to Sheet Metal Contractor, on-site, with copies to the Consultant. Retest corrected ductwork.
- .10 Co-operate and work with the controls contractor in the verification of the operation of all systems. Work shall include but not be limited to: adjustment of variable air volume boxes at minimum and maximum settings on a call for heating or cooling from the thermostat.

### 3.3 TESTING, ADJUSTING AND BALANCING REPORT

- .1 Prepare and submit to the Consultant, when the work is complete, bound, identified copies of a testing and balancing report as specified in the article entitled "SUBMITTALS" in PART 1 of this Section. Prepare the report using standard AABC, NEBB or equal forms to indicate all measurements required by the referenced balancing standard, including, but not limited to, the following:
  - .1 air handling system measurements for:
    - .2 air velocity;
    - .3 static pressure;
    - .4 velocity pressure;
    - .5 temperatures (wet bulb and dry bulb);
    - .6 cross-sectional area;
    - .7 RPM;
    - .8 electrical power voltage and current draw;

## SECTION 15890 – TESTING, ADJUSTING AND BALANCING

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- .9 air handling system location of equipment measurements for the inlet and outlet of each fan, coil, filter, damper, and other auxiliary equipment;
  - .10 air handling system location of system measurements at:
    - .1 main ducts;
    - .2 main branch ducts;
    - .3 sub-branch ducts;
    - .4 each supply, return and exhaust air inlet and outlet;
    - .5 all other auxiliary equipment;
    - .6 all areas served by the system.
  - .11 heat transfer system measurements for:
    - .1 flow;
    - .2 pressure;
    - .3 temperature;
    - .4 specific gravity;
    - .5 RPM;
    - .6 electrical power current draw and voltage.
  - .12 heat transfer system location of equipment measurements at the inlet and outlet of each:
    - .1 coil;
    - .2 heat exchanger (primary and secondary sides);
    - .3 boiler
    - .4 circulating pump;
    - .5 pressure reducing valve;
    - .6 make-up water;
    - .7 other auxiliary equipment;
  - .13 heat transfer system location of system measurements at the supply and return of each primary and secondary loop of each system;
  - .14 domestic hot water recirc. system location of equipment measurement for the inlet and outlet of each tank, heater and pump, and location of system measurements at each piping main, branch main, branch and sub-branch.
- .2 Include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic “As-built” diagram indicating all equipment and accessories.
  - .3 Include report sheets indicating building comfort test readings for all rooms.
  - .4 Prepare report sheets using the units of measurement (SI or Imperial) as used on the project construction documents.

### 3.4 VERIFICATION OF TESTING, ADJUSTING AND BALANCING REPORT

## **SECTION 15890 – TESTING, ADJUSTING AND BALANCING**

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- .1 When the testing, adjusting and balancing report has been received, the Consultant will schedule a site visit or visits for the purpose of verifying balancing results contained in the report. In addition to spot checking equipment performance, a maximum of 30% of all terminal equipment will be checked.
- .2 The testing and balancing agency shall accompany the Consultant during report verification, and shall supply all required tools and instruments to take measurements. Instruments used shall be the same instruments used in performing the testing and balancing work.
- .3 If, during the verification procedures, testing and balancing results indicated in the report are found to differ substantially with the results of spot checks, the report will be rejected by the Consultant, and testing, adjusting and balancing procedures shall be repeated and a new report issued for review and verification.
- .4 Testing, adjusting and balancing must be complete and accepted by the Consultant prior to application for a Certificate of Substantial Performance of the Work.
- .5 Include a copy of the accepted testing and balancing report in each copy of the operating and maintenance instruction manuals.

### **3.5 WARRANTY**

- .1 When testing, adjusting and balancing work is complete and the balancing report has been accepted, submit to the Project Manager, in the name of the Owner, an AABC National Guaranty Certification or NEBB Certificate of Conformance Certification, as applicable, and in addition, submit to the Project Manager, in the name of the Owner, a written extended warranty covering one (1) full heating season and one (1) full cooling season, during which time any balancing problems which occur in the building, with the exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by your personnel and reported on to the Project Manager. If it is determined that the problems are a result of improper testing, adjusting and balancing, they shall be immediately corrected without additional cost to the Owner.

### **3.6 SITE VISITS AFTER COMPLETION OF TESTING AND BALANCING**

- .1 After completion of testing, adjusting and balancing work and acceptance of the report, make the following follow-up site visits:
  - .1 once during the first month of building operation;
  - .2 once during the third month of building operation;
  - .3 once between the fourth and tenth months in a season opposite to the first or third month visit.
- .2 During each visit and accompanied by the Project Manager's representative, spot rebalance terminal units as required to suit building occupants and eliminate complaints.
- .3 Schedule each visit with the Consultant.
- .4 After each follow-up site visit, issue to the Consultant a report indicating any corrective work performed during the visit, all abnormal conditions and complaints encountered, and recommended corrective action.

**END OF SECTION 15890**

## **SECTION 16001 – LIST OF CONTENTS**

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### **DIVISION 16**

### **ELECTRICAL**

|               |   |
|---------------|---|
| SECTION 16002 | FORM OF SUPPLEMENTARY ELECTRICAL TENDER |
| SECTION 16010 | ELECTRICAL WORK GENERAL INSTRUCTIONS    |
| SECTION 16050 | ELECTRICAL BASIC MATERIALS AND METHODS  |
| SECTION 16400 | ELECTRIC SERVICE AND DISTRIBUTION       |
| SECTION 16500 | LIGHTING                                |
| SECTION 16510 | LIGHTING CONTROL SYSTEM                 |
| SECTION 16700 | COMMUNICATIONS                          |
| SECTION 16750 | TELECOMMUNICATION SYSTEMS               |
| SECTION 16850 | ELECTRIC HEATING                        |

**END OF SECTION**

**SECTION 16002 – FORM OF SUPPLEMENTARY ELECTRICAL TENDER**

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NAME OF BIDDING SUBCONTRACTOR: \_\_\_\_\_

DATE: \_\_\_\_\_

PROJECT: ROSEDALE RENOVATIONS  
FOR SSM HOUSING  
90 CHAPPLE ST  
SAULT STE MARIE, ONTARIO

To: MGP Architects + Engineer Inc.  
123 East Street  
Sault Ste. Marie, Ontario  
L3T 0A1

Attn: Mr. Elio Principe ([epincipe@mgp-arch-eng.ca](mailto:epincipe@mgp-arch-eng.ca))

Submit document in accordance with Document 00200 - Instructions to Bidders and submit a copy directly to MGP Architects + Engineer Inc. by means of e-mail addressed as above, within 4 hours after the Bid closing.

Note: Specifications shall govern over this list. Where names are added/deleted by addenda, it shall be understood that this list will reflect the respective changes. Failure to complete and submit this document as directed may result in your Bid being ruled informal.

**DIVISION 16 LIST OF MANUFACTURERS/SUPPLIERS**

We submit, herein, typed or neatly printed, the names of the manufacturers upon whose products our Bid Price is based and which we will supply. If no name is indicated, or if name identified is not listed in issued documents, or if more than one name is indicated for a particular product, we will if requested, provide the base specified manufacturer's product. Where products are named in the specifications with only one (1) manufacturer/supplier, or are not listed herein, we are also prepared to provide the base specified named product. We will provide Canadian manufactured products if costs and quality are similar.

We understand that the first manufacturer specified for any product is the manufacturer upon whose product the design is based, and that the other manufacturers specified for a particular product are manufacturers acceptable to the Owner and whose product produces equivalent quality, performance and size. We further understand if we indicate a manufacturer other than the manufacturer whose product is the basis of the design, we are responsible for ensuring that the product supplied is equivalent in quality, performance and size to the base design product, and that any additional costs incurred as a result of use of such products will be borne by us. Acceptance of non-base specified manufacturers with respect to their equivalency shall be at Consultant's sole discretion.

**SECTION 16002 – FORM OF SUPPLEMENTARY ELECTRICAL TENDER**

| <b>SECTION</b> | <b>PRODUCT/WORK</b>                             | <b>MANUFACTURER/SUPPLIER &amp; CATALOGUE NUMBER/COMPANY</b> |
|----------------|---|---|
| 16050          | Switches & Receptacles                          |   |
| 16050          | Firestopping & Smoke Seal Materials             |   |
| 16050          | Cable Tray                                      |   |
| 16050          | Surface Raceways                                |   |
| 16400          | Switchboard                                     |   |
| 16400          | Transformers                                    |   |
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## **SECTION 16010 – ELECTRICAL WORK GENERAL INSTRUCTIONS**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 The “General Conditions,” Documents and all Sections of Division 1 apply to and are a part of this Section.

#### **1.2 APPLICATION**

- .1 This Section applies to and is an integral part of all Sections of Division 16.

#### **1.3 DEFINITIONS**

- .1 The following are definitions of words found in Sections of Division 16 of the Specification and on associated drawings:
  - .1 “concealed” - means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions;
  - .2 “exposed” - means work normally visible, including work in equipment rooms, tunnels, and similar spaces;
  - .3 “provide” (and tenses of “provide”) - means supply and install complete;
  - .4 “install” (and tenses of “install”) - means secure in position, connect complete, test and verify;
  - .5 “supply” - means supply only;
  - .6 “BAS” – means Building Automation System; reference to “BAS”, “BMS” – Building Management System; and “FMS” – Facilities Management System, shall generally mean the same.

#### **1.4 EXAMINATION OF SITE**

- .1 Carefully examine all conditions at the site that will or may affect electrical work, and become familiar with site conditions and work associated with electrical work in order that your tender price includes for everything necessary for completion of the electrical work.
- .2 Ensure that materials and equipment are delivered to the site at the proper time and in such assemblies and sizes so as to enter into the building and to be moved into spaces where they are to be located without difficulty.

#### **1.5 PHASING**

- .1 Phasing and scheduling of the Work may be required. Include in your Bid Price all costs (including costs for “off hours” work) for scheduling, coordination and construction phasing to suit this project if specified in Division 1 and/or on the drawings.

#### **1.6 PLANNING AND COORDINATION**

- .1 The exact locations and routing of mechanical and electrical services shall be properly planned, coordinated and established with all affected trades prior to installation such that the services will clear each other as well as any obstructions. Generally, give the right of way to piping requiring uniform pitch and locate and arrange other services to suit.
- .2 Prepare working detail drawings, supplementary to the contract drawings, when deemed necessary by the Consultant, for all areas where a multiplicity of services and/or equipment occur, or where the work due to architectural and structural considerations involves special study and treatment. Submit working detail drawings to the Consultant in shop drawing form for review before the affected work is installed.

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- .3 Carry out all alterations in the arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with the contract documents, in order to conceal the work behind finishes, or to allow the installation of other work, without additional cost. In addition, make any alterations necessary in other work required by such alterations, without additional cost.
- .4 The Owner and the Consultant reserve the right to relocate electrical components such as receptacles, switches, communication system outlets, hard wired outlet boxes and luminaries at a later date, but prior to installation, without additional cost to Owner, assuming that the relocation per components do not exceed 3 m (10') from the original location. No credits will be anticipated where relocation per components of up to and including 3 m (10') reduces materials, products and labour. Should relocations per components exceed 3 m (10') from the original location the Contract Price will be adjusted from that portion beyond 3 m (10') in accordance with the provisions for changes in the Contract Documents.
- .5 Make necessary changes, due to lack of coordination, as required and when approved, at no additional cost, to accommodate structural and building conditions.
- .6 Whether shown on drawings or not, leave adequate space and provision for servicing of equipment and removal and reinstallation of replaceable items. Comply also with code requirements with regards to space provision around electrical equipment.

### 1.7 DOCUMENTS

- .1 In the case of discrepancies or conflicts between the Drawings and Specifications, the Documents will govern in order specified in the "General Conditions", however, when the scale and date of the Drawings are the same, or when the discrepancy exists within the documents, include the most costly arrangement.
- .2 The Specification is arranged in accordance with the CSI/CSC 16 Division Format with supplemental Controls Section of Division 15. Sections of Division 16 are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and the Sections are to be read as a whole.
- .3 The electrical drawings are performance drawings, diagrammatic, and show approximate locations of equipment and materials. The drawings are intended to convey the scope of work and do not show architectural and structural details. The locations of materials and equipment shown may be altered, when reviewed by the Consultant, to meet requirements of the material and/or equipment, other equipment and systems being installed, and of the building. Provide all fittings, offsets, transformations, and similar items required as a result of obstructions and other architectural or structural details but not shown on the electrical drawings.
- .4 The Specification does not generally indicate the specific number of items or amounts of material required. The Specification is intended to provide product data and installation requirements. It is necessary to refer to schedules, drawings (layouts, riser diagrams, schematics, details) and the Specification to provide correct quantities. Singular may be read as plural and vice-versa in the Specification.
- .5 Starter schedule drawings are both mechanical and electrical drawings and apply to the work of Division 15 and Division 16.
- .6 The drawings and Specifications are prepared solely for use by the party with whom the Consultant has entered into a contract and there are no representations of any kind made by the Consultant to any party with whom the Consultant has not entered into a contract.
- .7 Bidders finding discrepancies in, or omissions from the Bid documents, or having doubt as to the meaning or intent thereof, shall at once notify the Consultant, in writing. If a response is required at the discretion of the Consultant, a written instruction in the form of addendum shall be sent to all Bidders. All such addenda shall become part of the Contract Documents. Neither Owner nor Consultant will be responsible for verbal instructions.

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### 1.8 EQUIPMENT LOADS

- .1 All equipment loads (self weight, operating weight, house keeping pad, inertia pads, etc.) must be supplied by Electrical Contractor to the Consultant, via shop drawing submissions, prior to construction.
- .2 When the choice of specific equipment is made by the Contractor, the actual weight, location and method of support of the equipment may differ from those initially given to the Consultants and thus from those assumed for design. Consequently, it is necessary to back-check all equipment loads, location and supports.
- .3 Where the supporting structure consists of structural steel framing, it is imperative that the equipment loads, location and method of support be confirmed prior to the fabrication of the structural steel. Be responsible for confirming the locations of all equipment with the Consultant prior to construction.

### 1.9 OPENINGS

- .1 All opening sizes and locations must be supplied to the Consultant to allow verification of their affect on the design, and for inclusion on the structural drawings where appropriate.
- .2 No openings will be permitted through the completed structure without written approval of the Consultant. Any openings which are required through the completed structure must be clearly and accurately shown on a copy of the structural drawings. Exact locations, elevations and size of the proposed opening must be identified and submitted to the Consultant for review, well in advance of doing the work.

### 1.10 SHOP DRAWINGS

- .1 Submit for review, properly identified and dimensioned shop drawings showing in detail the design, construction and performance of equipment and materials as requested in Sections of the Specification. Include dimension drawings, system block diagrams and wiring schematic drawings. The shop drawings must be submitted to the Consultant for review prior to ordering and installation of equipment.
- .2 Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS," include your company name, the submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned for resubmittal. The number of copies of shop drawings shall be ten (10)
- .3 The Consultant will review shop drawings and will indicate his review status by stamping shop drawing copies as follows:
  - .1 "REVIEWED" or "REVIEWED AS NOTED" - If the Consultant's review of shop drawing is final, the Consultant will stamp the shop drawing "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked).
  - .2 "REVISED & RESUBMIT" - If the Consultant's review of shop drawing is not final, the Consultant will stamp the shop drawing "REVISED & RESUBMIT," mark the submission with his comments, and return the submission. Revise the shop drawing in accordance with the Consultant's notations and resubmit.
- .4 It is understood that the following is to be read in conjunction with the wording on the Consultant's shop drawing review stamp applied to each and every shop drawing submitted:

## **SECTION 16010 – ELECTRICAL WORK GENERAL INSTRUCTIONS**

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“THIS REVIEW BY MGP ARCHITECTS \* ENGINEER INC IS FOR THE SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH THE GENERAL DESIGN CONCEPT FOR ARCHITECTURAL FEATURES ONLY AND DOES NOT IN ANY WAY CONSTITUTE REVIEW OF THE DESIGN OF ENGINEERING ELEMENTS WHICH FORM PART OF THE CONTRACT DOCUMENTS PREPARED BY OTHERS. THIS REVIEW SHALL NOT MEAN THE MGP ARCHITECTS \* ENGINEER INC APPROVES THE DETAIL DESIGN INHERENT IN THE SHOP DRAWINGS, RESPONSIBILITY FOR WHICH SHALL REMAINS WITH THE CONTRACTOR SUBMITTING THE SAME, AND SUCH REVIEW SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY FOR MEETING ALL REQUIREMENTS OF THE CONTRACT DOCUMENTS. THE CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT THE JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATIONS PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR CO-ORDINATION OF THE WORK OF ALL SUBTRADES.”

- .5 Each system (i.e.: fire alarm system, security system, etc.) and each major component (i.e.: switchboard, transformer etc.) shall each be separate shop drawing submissions. Shop drawings for common devices such as devices of each system or all luminaires, shall be submitted together.
- .6 Shop drawings for submission shall be obtained from product manufacturer’s authorized representatives and supplemented with additional specified requirements.

### **1.11 WORK STANDARDS**

- .1 Where regulatory codes, standards and regulations are at variance with the Drawings and Specification, the more stringent requirement will apply.
- .2 Where any code, regulation, by-law or standard is quoted it means, unless otherwise specifically noted, the current edition including all revisions or amendments at the time of the Contract. Where references are made to printed instructions, it means the current edition of such instructions.
- .3 Supplementary mandatory Specifications and requirements to be used in conjunction with the project shall include the following:
  - .1 Ontario Electrical Safety Code (OESC);
  - .2 Electrical Safety Authority (ESA);
  - .3 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
  - .4 Ontario Building Code (OBC);
  - .5 Canadian Standards Association (CSA);
  - .6 Underwriters’ Laboratories of Canada (ULC);
  - .7 National Building Code of Canada (NBC);
  - .8 Illuminating Engineering Society (IES);
  - .9 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., (ASHRAE);
  - .10 Hydro inspection permits;
  - .11 Local Codes of governing authorities.
- .4 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.

### **1.12 PERMITS, CERTIFICATES AND FEES**

- .1 Obtain and pay for all permits, certificates and inspections required to complete electrical work.

## **SECTION 16010 – ELECTRICAL WORK GENERAL INSTRUCTIONS**

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- .2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of the work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of the Work. Include costs for ESA inspections and certifications of approvals, as required.
- .3 Include in each copy of operating and maintenance instruction manuals, copies of inspection certificates issued by regulatory authorities to certify that the completed work is in accordance with the regulations of the regulatory authorities and is acceptable to them.
- .4 Where work includes any electromagnetic lock work whether or not such devices are supplied by Division 16, include for obtaining and paying for required applicable certificates of electromagnetic lock work.

### **1.13 CHANGES OR REVISIONS TO THE WORK**

- .1 Wherever the Consultant proposes in writing to make a change or revision to the design, arrangement, quantity or type of any work from that called for on or in the contract documents, submit to the Consultant for approval, a detailed, itemized, estimate breakdown of the cost of all equipment, materials and labour entering into each change or revision.
- .2 Do not execute any changes or revisions until written authorization for such changes or revisions has been issued by the Consultant.
- .3 Note: For any revision which includes deleted work as well as additional work, the total cost of the deleted work must be subtracted from the cost of the additional work before adding percentages for overhead and profit.

### **1.14 CLEANING UP**

- .1 During construction, keep the site reasonably clear of rubbish and waste material resulting from electrical work on a daily basis to the satisfaction of the Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove all of your rubbish and debris, and arrange for and pay for the repair of any damage caused as a result of electrical work.
- .2 At time of final cleaning, clean luminaire reflectors, lenses, and other luminaire surfaces that have been exposed to construction dust and dirt, including the top surface, whether exposed or in the ceiling space.
- .3 Clean switch, receptacle, and communications outlets, coverplates, and exposed surfaces.
- .4 Clean all other electrical and devices installed as part of this project.
- .5 For electrical equipment rooms, electrical closets and communication closets, perform the following:
  - .1 Using HEPA type vacuum cleaner, thoroughly vacuum and clean interiors and buswork of all switchboards, panels, cabinets and other electrical equipment of all construction debris and dust prior to energization.
  - .2 HEPA vacuum the top of all switchboards, panels, cabinets, bus ducts, cable trays and conduits, and all mechanical duct work in room, followed by a thorough HEPA vacuuming of the floors. Thoroughly wash floors with wet mop and clean water. Control access to the room after cleaning. Provide temporary filter media on air supply ducts to these rooms to prevent re-contamination from other areas of construction.
  - .3 Thoroughly re-clean as necessary prior to final turn over to Owner.
  - .4 Do not lay permanent switchboard matting in electrical rooms until rooms are thoroughly re-cleaned, and floors wet mopped and dried, immediately prior to final turn over to Owner.

## SECTION 16010 – ELECTRICAL WORK GENERAL INSTRUCTIONS

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### 1.15 FINAL INSPECTION

- .1 Submit to Consultant, written request for final inspection of system. Include with this submission written certification that:
  - .1 deficiencies noted during job inspection have been completed;
  - .2 field quality control procedures have been completed;
  - .3 systems have been tested and verified, and are ready for operation;
  - .4 completed maintenance and operating data have been submitted and approved;
  - .5 tags are in place and equipment identified have been completed;
  - .6 cleaning up is complete;
  - .7 spare parts and replacement parts specified have been provided and receipt acknowledged by Consultants;
  - .8 as-built and Record drawings have been completed and approved;
  - .9 Owner's staff have instructed in operation and maintenance of systems;
  - .10 fire alarm verification has been 100% completed and Verification Certificate has been submitted and accepted;
  - .11 commissioning procedures have been completed.

### 1.16 RECORD "AS-BUILT" DRAWINGS

- .1 The drawings for this project have been prepared on a CAD system using AutoCAD Release 2004 software. For the purpose of producing record "as-built" drawings, copies of contract drawings shall be purchased from the Engineer, at the Contractor's expense of \$25.00 CDN plus GST, per drawing up to first ten (10) drawings, and \$5.00 CDN per any additional drawings thereafter.
- .2 When work begins at the site, clearly and accurately mark on a bound set of white prints of the Contract Drawings, on a daily basis, all changes and deviations from the routing of main service and system feeders and locations of equipment shown on the Contract Drawings. Changes and deviations include those made by addenda, change orders, and site instructions, and changes and deviations indicated on supplemental drawings issued with addenda, change orders, and site instructions. Maintain the "As-built" white prints at the site for periodic inspection by the Consultant throughout the duration of the work.
- .3 Pay particular attention to accurately dimensioning the location of all concealed services terminated for future extension, and work concealed within the building in inaccessible locations.
- .4 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of the Contract Document drawing set in accordance with the marked-up set of "as-built" white prints including all deviations from original Contract Document drawings, thus forming an "as-built" drawing set. Submit the "as-built" site drawing prints to the Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of Consultant.
- .5 Use the final reviewed "as-built" drawing set to provide CAD files of the drawings thus forming true "as-built" set of contract drawings. Load drawing files onto Compact Discs (CDs). Provide two (2) complete sets of "as-built" drawings on separate CDs. Submit the "as-built" sets of white prints and discs to Consultant.
- .6 Prepare and submit for review with record drawings, a neat, clear, properly identified, "As-built" electrical riser diagram record drawing (in AutoCAD 2004 format) of the entire electrical distribution system up to and including line side connections to panelboards. The diagram shall include feeder types and sizes, conduit sizes, breaker, switchboard and distribution panel sizes, etc., and must be approved by the Consultant. The diagram shall be as same size as the issued full size project drawings. Riser diagrams shall be mounted on 10 mm (3/8") thick foam core complete with mylar finish cover, and hardware suitable for wall mounting in the main electrical room.

## **SECTION 16010 – ELECTRICAL WORK GENERAL INSTRUCTIONS**

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- .7 All submitted drawings shall be of the same quality as original contract document drawings. The CAD drawing files shall be of form compatible with the Consultant's existing AutoCAD software.

### **1.17 OPERATING AND MAINTENANCE INSTRUCTION MANUALS**

- .1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply three (3), project specific, indexed copies of equipment manufacturer's operating and maintenance instruction data manuals. Consolidate each copy of the data in an identified hard cover three-ring binder. Each binder shall include:
  - .1 front cover with project name clearly labelled;
  - .2 detailed list of contents;
  - .3 contact names and telephone numbers for major pieces of equipment and systems;
  - .4 a copy of each "reviewed" shop drawing;
  - .5 complete explanation of operation principles and sequences;
  - .6 complete part lists with numbers;
  - .7 recommended maintenance practices and precautions;
  - .8 copies of all inspection certificates issued by regulatory authorities;
  - .9 complete wiring and connection diagrams;
  - .10 copies of all test reports;
  - .11 copies of warranties;
  - .12 photocopies of panelboard directories;
  - .13 items requested specifically in Section Articles.
- .2 The operating and maintenance instructions must relate to the job specific equipment supplied under this project and relate specifically to the Owner's building. The language used in the manuals shall be simple practical operating terms and language easy for the in-house maintenance staff to understand how each system should operate and should be maintained.
- .3 Submit the operating and maintenance instruction manuals to the Consultant before applying for a Certificate of Substantial Performance of the Work.
- .4 When shop drawings are returned to you marked "REVIEWED AS NOTED" with revisions marked on the shop drawing copies, such shop drawings are to be revised by the equipment supplier to incorporate the comments marked on the "reviewed" shop drawings and a clean updated copy is to be included in the operating and maintenance manual.

### **1.18 WARRANTY**

- .1 Warrant the electrical work to be in strict accordance with the Contract Documents and free from defects for a period of 1 year from the date of issue of a Certificate of Substantial Performance of the Work.

### **1.19 EXTENDED WARRANTIES**

- .1 Where equipment specified in Sections of Division of the Specification has an extended warranty period, e.g., 5 years, the first year of the warranty period will be governed by the terms and conditions of the warranty in the Contract Documents, and the remaining years of the warranty are to be direct from the equipment manufacturer and/or supplier to the Owner. Submit signed and dated copies of extended warranties to the Consultant before applying for a Certificate of Substantial Performance of the Work.

## SECTION 16010 – ELECTRICAL WORK GENERAL INSTRUCTIONS

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### 1.20 EQUIPMENT AND MATERIALS

- .1 Provide Canadian manufactured products wherever possible and where required quality and performance is obtainable at competitive prices. Products shall be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, all materials and apparatus shall be new and shall comply with applicable respective CSA Standards and/or ULC listings. Equipment shall meet or exceed ASHRAE/IES 90.1 Standards, as applicable. Do not provide any products containing asbestos or PCB materials.
- .2 Materials and equipment scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any material or equipment specified by manufacturer's name and model number. Generally, where acceptable manufacturers are listed, the first name listed is the base specified company. The Bid Price may be based on materials and equipment supplied by any of the manufacturer's base specified or named as acceptable for the particular material or equipment. If acceptable manufacturers are not stated for a particular material or piece of equipment, base the Bid Price on material supplied by the base specified manufacturers.
- .3 The listing of a product as "acceptable" does not imply automatic approval by the Consultant and/or Owner. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for products/systems that meet or exceed the specifications included herein.
- .4 If materials or equipment supplied by a manufacturer named as acceptable are used in lieu of the base specified manufacturer, be responsible for ensuring that the material or equipment is equivalent in performance and operating characteristics (including energy consumption if applicable) to the base specified materials or equipment, and, it is to be understood that any additional costs (i.e. larger feeders, larger starters, additional space, etc.), and changes to associated or adjacent work resulting from provision of materials supplied by a manufacturer other than the base specified manufacturer is included in the Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and the dimensions of such equipment differs from the base specified equipment, prepare and submit for review, accurately dimensioned layouts of rooms affected.
- .5 In addition to the manufacturer's base specified or named as acceptable, other manufacturers of materials or equipment may be proposed as substitutions to the Consultant for acceptance, listing in each case a corresponding credit for each substitution proposed, however, the Bid Price must be based on equipment or materials base specified or named as acceptable. Certify in writing to the Consultant that the proposed substitution meets all space, power, design, energy consumption, and all other requirements of the base specified or acceptable material or equipment. In addition, it is to be understood that there will be no increase in the Contract Price by reason of any changes to associated equipment, mechanically, electrically or architecturally, required by acceptance of proposed substitution. The Consultant has sole discretion in accepting any such proposed substitution of material or equipment. Indicate any proposed substitutions in areas provided on Bid Form.
- .6 Submit the names of the manufacturers/suppliers for materials and equipment that you will supply, and which were specified or scheduled with a manufacturer's/supplier's name. Note: The names of manufacturers on the list must be one (1) of the names as base specified or named acceptable for the particular products, unless prior written permission has been given for use of products by other manufacturers. If names are not submitted, or if name identified is not listed in issued documents, or if more than one (1) name is identified for a product, it shall be assumed and expected that the base specified products will be provided. Submit copy of Document 16002 as per instructions within the Document. Product manufacturer/suppliers shall not be changed unless approved by Consultant and generally in extraordinary circumstances at Consultant's discretion.



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- .7 Where products are listed as “or approved equal,” certify in writing that the product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of the base specified product and thus shall be equivalent or better than the base specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these “or approved equal” products shall be at the sole discretion of the Consultant. There shall be no increase in Contract price due to Consultant’s rejection of proposed equivalent product. Do not order such product until accepted in writing by Consultant.
- .8 Whenever use of product other than base specified product is being supplied, ensure that the corresponding certifications and product information are submitted to Consultant for review and approval. Failure of submission of these approval documents to Consultant in timely manner to allow for review and approval within the constraints of the Work schedule, shall result in base specified product to be supplied at Consultant’s discretion, at no additional cost to Contract. Note that this procedure and resultant approval of a product not base specified shall not in any way delay the work schedule. Do not order such product until such product is accepted in writing by Consultant.
- .9 Any proposed changes initiated by the Contractor after award of Contract may be considered by Consultant at Consultant’s discretion, with additional costs for such changes if approved by Consultant, and costs for such review, to be borne by the Contractor.

### **1.21 IMPERIAL AND METRIC MEASUREMENTS**

- .1 Generally, both imperial and metric units of measurement are given in Sections of the Specification governed by this Section. Metric conversions are “soft” and have been rounded off.

### **1.22 BREAKDOWN OF ELECTRICAL WORK COST**

- .1 Submit to the Consultant a typewritten breakdown of the electrical work cost with a schedule of values of the various parts of the work, aggregating the total cost of the electrical work.
- .2 The extent of the breakdown shall be as directed by the Consultant. The breakdown must be acceptable to the Consultant and is required to assist in evaluation of monthly progress draws.
- .3 Submit the breakdown within 10 days of written notification of acceptance of bid and award of Contract.

### **PART 2 - PRODUCTS**

NIL

### **PART 3 - EXECUTION**

NIL

**END OF SECTION 16010**

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- 3.24 FINISH PAINTING OF ELECTRICAL WORK
- 3.25 INSTRUCTIONS TO OWNER

**PART 1 - GENERAL**

**1.1 REFERENCES**

- .1 Section 16010, applies to and is a part of this Section.

**1.2 APPLICATION**

- .1 This Section specifies products, common criteria and characteristics, and methods and execution that are common to one (1) or more Sections of Division 16. It is intended as a supplement to succeeding Sections of Division 16 and shall be read accordingly.

**1.3 SHOP DRAWINGS**

- .1 Submit shop drawings for the following:
  - .1 a manufacturer's catalogue sheet or sheets indicating proposed switches and receptacles;
  - .2 cable tray complete with copy of CSA certificate;
  - .3 surface raceways;
  - .4 firestopping and smoke seal materials complete with ULC listing and dedicated ULC number;
  - .5 vibration controls and seismic restraints.

**1.4 SUBMITTALS**

- .1 Submit the following to the Consultant for review:
  - .1 a sample of each proposed type of access door, as well as prints of reflected ceiling plan drawings showing proposed ceiling access door locations;
  - .2 dimensioned location drawings indicating all required sleeves and formed openings in structural poured concrete or precast concrete construction;
  - .3 samples of materials and any other items as specified in succeeding Sections of this Division;
  - .4 sample board of wiring devices and faceplates with finishes and colour samples.
  - .5 proposed nameplate sizing, colours, symbols and nomenclature.

**1.5 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 The following work which is related to the work of Division 16 is specified in other Sections of other Divisions of the Specification:
  - .1 installation of access doors in building finishes;
  - .2 finish painting of exposed electrical work.

**1.6 TYPICAL DETAILS**

- .1 Refer to typical details on the drawings for references to products and/or execution required in this Section.

**1.7 REQUIREMENTS FOR BARRIER FREE ACCESS**

- .1 Provide applicable requirements for physically challenged persons and for barrier free access in accordance with the latest edition of the OBC.

**1.8 SPRINKLER PROOFING**

- .1 Provide drip shields for protection of equipment from water spray and dripping of liquids.
- .2 The shields shall be constructed from non combustible materials, (sheet steel) and enamel painted of colour finished to match equipment. All surfaces and edges shall be filed/sanded smooth, prior to painting.
- .3 Shields shall be supported from equipment with structural steel rods/metal framing or other method approved by Consultant. Structural supports shall be finish painted to match shield.
- .4 Include with equipment shop drawings, detailed dimension of shields and method of support.
- .5 Equipment with top cable/conduit entries shall include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.
- .6 Ventilation louvers shall be designed such that “live components” shall not be exposed to water spray and dripping liquids.
- .7 The above requirements are general minimum additional “sprinkler proof” standards for equipment specified as “EEMAC 1 or 2”, and shall generally be provided by the respective equipment manufacturers, unless otherwise noted or approved by Consultant. CSA approvals shall be obtained, where required.

**PART 2 - PRODUCTS**

**2.1 CONDUIT**

- .1 EMT (Thinwall), galvanized electrical metallic tubing to CSA C22.2 No. 83, complete with factory made bends where site bending is not possible and joints and terminations made with steel couplers and set screw type steel connectors with insulated throats, concrete tight where required.
- .2 Rigid galvanized steel to CSA C22.2 No. 45, with exterior zinc and interior enamel coatings, galvanized threads where factory cut, red lead coated threads where site cut, factory made bends where site bending is not possible, factory made and threaded fittings and connectors, and terminations with rigid couplings, concrete tight where required.
- .3 Galvanized steel flexible liquid-tight metallic conduit to CSA C22.2 No. 56, complete with Ideal “Steel Tough” liquid-tight flexible conduit connectors at terminations.
- .4 Galvanized steel flexible metallic conduit to CSA C22.2 No. 56, complete with proper and suitable squeeze type connectors at terminations.
- .5 CSA approved and labelled, FT-4 rated, rigid plastic (PVC) conduit complete with site made heat gun bends on conduit to 50 mm (2") diameter, factory made elbows in conduit larger than 50 mm (2") diameter, solvent weld joints, factory made expansion joints where required, and terminations made with proper and suitable connectors and adaptors.
- .6 Medium density CSA certified polyethylene flexible plastic conduit in a continuous coil of the proper length.

**2.2 CABLE TRAY**

- .1 Thomas & Betts - Electrotray, generally 300 mm x 100 mm (12" W x 4" D) unless otherwise noted on drawings, rated for minimum CSA load D1, must be CSA approved and labelled, ladder type cable tray manufactured from electro galvanized steel, with maximum 150 mm (6") rung spacing and supplied in 3 m (10') lengths. Refer to the drawings for approximate tray routings and lengths.
- .2 Tray shall be complete with factory made conduit connectors, couplers, fittings, tee sections, elbows, universal dropouts, etc., and required supporting and installation accessories. Include for a trapeze configuration of threaded rod supports secured to ceiling slab and extending down to secure to C-channel support creating a cradle for support of ceiling mounted cable tray system. Cable tray shall be connected continuously with no breaks.

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- .3 Clean final finish of burrs and other material or imperfections prior to installation of cabling, to satisfaction of the Consultant.
- .4 Provide tray complete with tray manufacturer's grounding/bonding fittings and hardware.
- .5 Provide conduit fittings where conduits enter tray and provide dropouts at ends where cables exit/enter. Supply cable installation rollers for pulling cables safely into tray. System accessories shall be supplied by system manufacturer and must be as recommended for specific applications.
- .6 Factory fabricate changes in direction, tees, 90° bends, universal dropouts, etc. Provide hardware to maintain network cabling bending radii at EIA/TIA Standards for the Category rating of cabling.
- .7 Where cable tray penetrates fire rated construction, provide ULC listed and labelled, fire stopping and smoke seal materials or fittings to protect the integrity of the fire rated construction. Install work in compliance with ULC standards and where required by local governing codes, provide suitable for plenum environments.
- .8 Acceptable manufacturers are:
  - .1 Thomas & Betts (Electrotray/Pilgrim/Canstrut);
  - .2 Legrand-Wiremold;
  - .3 Cooper B-Line;
  - .4 Canadian Electrical Raceways.

### 2.3 OUTLET BOXES

- .1 CSA approved stamped galvanized steel outlet boxes.
- .2 Crouse-Hinds Canada Ltd., CSA certified, "FS" or "FD" Series cast Feraloy and aluminum outlet boxes.
- .3 CSA certified, rigid plastic (PVC) outlet boxes.
- .4 Hubbell Canada Inc., CSA approved, fully adjustable, both vertically and angular, formed galvanized steel, round/rectangular/square as required, flush, concrete floor mounting, boxes complete with adjustable collars, brass screw on or hinged flip open covers with provisions for mounting of duplex power receptacles, telephone jacks and data jacks. Boxes with both power and communication outlets shall be barriered.
- .5 Each outlet box and back box must be suitable in all respects for the application, and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers and any other required accessory.
- .6 Surface mounted boxes shall be solid construction.

### 2.4 PULLBOXES AND JUNCTION BOXES

- .1 Galvanized or prime coat plated steel, suitable in all respects for the application and complete with screw-on or hinged covers as required, and connectors suitable for connected conduit.
- .2 Crouse-Hinds Canada Ltd., "Condulet", threaded cast Feraloy outlet boxes of an exact type to suit the application, each complete with screw-on gasketed cover.
- .3 Rigid plastic (PVC), CSA certified, junction boxes and access fittings with solvent weld type joints and screw-on PVC covers.
- .4 The physical size of pullboxes shall be as required by the OESC to suit the number and size of conduits and conductors.

**2.5 CONDUCTORS AND CONNECTORS**

- .1 "T90 Nylon" single copper conductor to CSA C22.2 No. 75, colour coded, 194 degrees F. (90 degrees C.) rated, PVC insulated and nylon covered.
- .2 "TWU" single conductor to CSA C22.2 No. 75, colour coded, -40 degrees F. (-40 degrees C.) rated, PVC insulated.
- .3 "AC-90" flexible armoured cable with "RW-90" conductors and bare copper ground conductor to CSA C22.2 No. 51 (Bulletin No. 994).
- .4 Conductors to and including No. 10 AWG. shall be solid. Conductors in sizes larger than No. 10 AWG. shall be stranded. All conductors shall be constructed of 98% conductive copper and shall be approved for minimum 600 volts.
- .5 Armoured cable connectors shall be proper squeeze type connectors and plastic anti-short bushings at terminations.
- .6 Connectors for conductors in conduit shall be equal to IDI Electric (Canada) Ltd., "Ideal" No. 451, No. 452 and No. 453, "Wing-Nut", CSA certified, 600 volts, rated pressure type connectors.

**2.6 LOW VOLTAGE (24 VOLT) CONDUCTORS**

- .1 ULC listed and labelled, CSA certified to C22.2 No. 127, No. 18 AWG "TEW" thermoplastic insulated wire rated for 600 volts service, and 220 degrees F. (105 degrees C), complete with the required number of copper conductors and colour coding.
- .2 Nexans, "Securex II", FAS 105, 300 volts, 220 degrees F. (105 degrees C.) rated fire alarm system flexible armoured cable with solid copper conductor, flame retardant PVC insulation and red colour outer jacket, ULC listed and labelled and CSA certified to C22.2 No. 208. Cable shall be complete with overall jacket.

**2.7 CONDUCTOR PULLING LUBRICANT**

- .1 IDI Electric (Canada) Ltd., "Ideal Yellow 77" or "Wire Lube" as required.

**2.8 SWITCHES AND RECEPTACLES**

- .1 The switches and receptacles in the following paragraphs shall be CSA certified devices.
- .2 Hubbell Canada Inc., HBL 1221 Series, CSA approved, extra heavy duty, industrial grade, back and side wired, A.C. quiet action toggle type, 20 ampere, and 120/277 volts switches. Switches shall include steel-nickel plated bridge, nylon toggle, one piece rivetless copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide key type switches where required.
- .3 Hubbell Canada Inc., No. HBL 5262 CSA approved, ULC listed, extra heavy duty industrial grade, back and side wired, nylon face/body construction, duplex U ground, 15 ampere, 125 volts, 2 pole, 3 wire grounding receptacles complete with one piece nickel-plated brass mounting strip with integral grounding clips, ground retention clips, nickel-plated brass wiring clamps with nickel-plated brass screws, front circuit identification area and reinforced thermoplastic base.
- .4 Hubbell Canada Inc. No. 1221 IL, CSA approved, heavy duty, Specification grade, AC quiet action, illuminated polycarbonate handle toggle type, 20 ampere, 120/277 volt switches.
- .5 Hubbell, No. GF 5262/GF 5362 series, Specification grade, 15/20 ampere, 125 volts, duplex, ULC Class "A", Group One, ground fault circuit interrupting receptacles (for climate controlled areas).
- .6 Hubbell, No. GFR 5262TR/GFR 5362TR Series, extra heavy duty, 15/20 ampere, 125 volts, duplex, ULC Class "A", Group One, tamper resistant, weather resistant ground fault circuit interrupting receptacles (for non-climate controlled areas).

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- .7 Hubbell Canada Inc., No. HBL 5362, (NEMA 5-20R alternate), heavy duty, specification grade, duplex, U-ground, 125 volts, 15/20 ampere, 2-pole, 3-wire receptacles.
- .8 Hubbell Canada Inc., No. 9430, EEMAC type 14-30R30 ampere, 125/250 volts, 3 pole, 4-wire single electric clothes dryer receptacles with steel faceplates.
- .9 Hubbell Canada Inc., No. 9450, EEMAC type 14-50R, 50 ampere, 125/250 volts, 3-pole, 4-wire single electric range receptacles with steel faceplates.
- .10 Hubbell Canada Inc., No. BR-15 series, specification grade, 15 ampere, 125 volts AC, 2-pole, 3-wire, duplex, tamper resistant, receptacles that limit access to energized internal components.
- .11 Crouse-Hinds Series EDS, CAS approved, hazardous location, explosion proof surface mounting, front operated switches and Crouse-Hinds ENR series hazardous location explosion proof receptacles. Devices shall be suitable for Class 1 Division 2 applications, unless otherwise noted by Consultant. Exact classification shall be confirmed with Consultant prior to ordering. Coordinate receptacle requirements with Owner to ensure compatibility with plugs.
- .12 Hubbell Canada Inc., No. 4710, heavy duty, 15 ampere, 125 volts, single, flush mounting twist lock receptacles.
- .13 The colour of switches and receptacles (unless specified above), shall be as specified in PART 3 of this Section of the Specification.
- .14 Special switches and receptacles not specified above will be specified on the drawings.
- .15 Acceptable manufacturers are Hubbell Canada Inc., Cooper Wiring Division, Pass & Seymour Canada Inc. and Leviton.

### 2.9 FACEPLATES

- .1 Grade 18-8, type 302/304, 1 mm (0.040") thick stainless steel, satin, brushed or natural finish, complete with a peel-off protective plastic film, and stainless steel screws.
- .2 Galvanized steel stamped faceplates.
- .3 Hubbell Canada Inc., No. WP8M, single gang, vertical mounting, weather-proof, in-use, gasketed, cast aluminum faceplates for standard duplex receptacles in wet locations.
- .4 Hubbell Canada Inc., No. WP26M, single gang, vertical mounting, weather-proof, in-use, gasketed, cast aluminum faceplates for GFI receptacles in wet locations.
- .5 Hubbell Canada Inc., forged brass "S" series faceplates.
- .6 The colour of faceplates shall be as specified in PART 3 of this Section.

### 2.10 SURFACE RACEWAYS

- .1 Panduit Series TG70, CSA certified, ULC listed and labelled, 3-piece (base, cover and divider), barriered, surface mounted non-metallic raceways, complete with the following:
  - .1 raceway, cover and divider;
  - .2 duplex grounding receptacles;
  - .3 snap on standard, and sloped horizontal and vertical faceplates;
  - .4 data outlet mounting bracket, as applicable;
  - .5 voice outlet mounting bracket, as applicable;
  - .6 ancillary boxes, wire retainers, clips, couplings, brackets, fittings, elbows, boxes, tees mounting hardware, etc., for a complete raceway system;
  - .7 wiring for power;



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- .8 of configurations as detailed on drawings.
- .2 Confirm and coordinate data/voice jack mounting requirements and network cabling requirements with network cabling system Contractor.
- .3 Colour finish of raceway shall be "International white" as confirmed with Consultant and Owner prior to ordering.
- .4 Acceptable manufacturers are Panduit, Legrand Wiremold and Hubbell.

### **2.11 SLEEVES**

- .1 Galvanized steel sleeves as follows:
  - .1 No. 24 gauge with an integral flange at one (1) end to secure the sleeve to formwork construction;
  - .2 Schedule 40 pipe.

### **2.12 FIRESTOPPING AND SMOKE SEAL MATERIALS**

- .1 Asbestos-free, elastomeric materials and in tumescent materials, tested, listed and labelled by ULC in accordance with CAN 4-S115-M85, and CAN/ULC-S101-M for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) not less than the fire rating for surrounding construction. The fire stopping and smoke seal material system must be specifically ULC certified with designated reference number for its specific installation. Submit to Consultant, copies of ULC certificate, number and drawings for each installation.
- .2 Systems shall consist of both elastomeric and in tumescent materials that shall be compatible with abutting dissimilar materials and finishes. Coordinate material requirements with trades supplying abutting areas of materials.
- .3 Include costs for and arrange for manufacturer's authorized representative to inspect and verify each installation and application. Submit test report signed and verified by Contractor and manufacturer's representative.
- .4 Acceptable certification shall also include certification by Underwriters Laboratories of Northbrook IL, using tests conforming to ULC-S115 and given CUL listing published by UL in their "Products Certified for Canada (CUL) Directory".
- .5 Acceptable manufacturers are 3M Canada Inc., Tremco, Specified Technologies Inc., A/D Fire Protection Systems and Hilti Canada.

### **2.13 FASTENING AND SECURING HARDWARE**

- .1 Concrete inserts - Crane Canada Ltd., No. 4-M for concrete work for single or double conduit, cable tray, etc., runs and for equipment, and Unistrut Ltd. or equal multiple type inserts for runs of three (3) or more conduits etc., or where a grid support system is required.
- .2 Concrete fasteners - "WEJ-IT" anchors, lead cinch anchors and/or "STAR" or "PHILLIPS" self-drilling anchors.
- .3 Masonry inserts - "WEJ-IT" expansion shields and machine bolts or, for light loads, fibre or lead plugs and screws.
- .4 Drywall or plaster wall and/or ceiling fasteners - two-wing spring toggles.
- .5 Structural steel - Crane Canada Ltd., beam clamps.
- .6 Metal framing channels - Unistrut 1-5/8" (40mm) width, hot dipped galvanized steel channels complete with required fittings and ancillary hardware; acceptable manufacturers include Thomas & Betts and Cooper B-Line.

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### **2.14 ACCESS DOORS**

- .1 Minimum No. 12 gauge prime coat painted steel flush access doors, each complete with a heavy frame and anchor, heavy duty rust-resistant concealed hinges, a positive locking screwdriver lock, and mounting and finishing provisions to suit the particular construction in which it is installed. Access door sizes shall suit the concealed work for which they are supplied. Access doors in fire rated ceilings, walls, partitions, structures, etc., shall be ULC listed and labelled and of a rating to maintain the fire separation integrity.
- .2 Where access doors are located in surfaces where special finishes are required, they shall be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout.

### **2.15 IDENTIFICATION NAMEPLATES**

- .1 Laminated plastic (Lamacoid) black lettering on white background with bevelled edges, stainless steel screws, and proper identification engraving.
- .2 Contractor to confirm exact equipment nomenclature wording with Consultant and Owner prior to installations.
- .3 Brother "P-Touch" or equivalent, portable electronic labelling system with securely affixed, self-adhesive identification labels, permanently printed with circuit identification nomenclature shall be provided on the fact plate of every receptacle through the building. Each label shall identify receptacle feed source and circuit number (i.e. PP01-26). Upon completion, turn over label maker to the Owner.

### **2.16 WARNING SIGNS**

- .1 Thomas & Betts Ltd. semi-rigid vinyl panels with drilled holes in each corner, stainless steel screws, pressure sensitive mounting pads on the back, and the required printed wording. Generally, wording shall be red on a white background with black trim.

### **2.17 SYSTEMS BACKBOARDS**

- .1 G1S construction grade fir plywood, flame retardant prime coat painted on both sides, minimum 20 mm (3/4") thick, with flame spread rating in accordance with OBC requirements. Where noted on the drawings, provide full wall height plywood backboard around entire room. These requirements are typical for all switching and LAN rooms.

## **PART 3 - EXECUTION**

### **3.1 GENERAL CONDUIT AND CONDUCTOR INSTALLATION REQUIREMENTS**

- .1 Install conduit and conductors concealed in all finished areas, and concealed to the degree made possible by finishes in partially finished and unfinished areas. Conduit may be exposed in unfinished areas such as Electrical and Mechanical Rooms, unless otherwise noted on the drawings or specified herein. Refer to and examine the architectural drawings and room finish schedules to determine finished, partially finished or unfinished areas of the building.
- .2 Where conduit and/or conductors are exposed, arrange same to avoid interference with other work and parallel to the building lines. Where horizontal conduits and/or conductors are exposed, install as high as possible. Do not install conduit and/or conductors within 150 mm (6") of "hot" pipes or equipment unless the conduit and/or conductors are associated with the equipment. Independently run conduit and conductors must be supported from the ceiling/wall structure, not from ceiling hangers, ductwork, piping, cable trays, etc.
- .3 Temporarily pack all open boxes located in concrete, plaster and masonry to prevent debris from entering the box.
- .4 Where conduit is to be embedded within structural concrete, install such conduit in compliance with the requirements of the latest edition of CSA Standard CAN3-A23.1-04, "Concrete Materials and Methods of Concrete Construction," with specific reference to Section 13.5. Generally, installation practices and methods shall be confirmed with and accepted by the Structural Consultant.

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- .5 All circuits must contain separate phase, neutral and ground conductors (i.e.: common neutral configuration is unacceptable). Conductors shall be minimum No. 12 AWG and No. 10 AWG for runs longer than 15 m (50').
- .6 At no extra cost, allow for final relocations of devices up to 3 m (10') to suit final coordinated device locations, prior to installation of wall coverings.
- .7 Generally, conductors and conduits are sized on drawings, but in absence of direction in type, sizing and quantity, type, size and provide quantity in accordance with the intended application, to applicable OESC requirements. Note that sizing shown on drawings are minimum requirements that shall not be reduced unless approved by Consultant.
- .8 Conduits and boxes in non-climate controlled areas shall be weatherproof and corrosion resistant construction. Provide proper NEMA rated boxes and enclosure to suit applications.
- .9 Conductors installed in cable tray and surface raceways shall be bundled separately by systems and tagged identifying the system. Conductors in cable tray running vertically shall be secured with ties in a manner to relieve and stress of the weight of cables. Cable ties shall be provided to applicable BICSI standards.

### 3.2 INSTALLATION OF CONDUIT

- .1 Provide conduit for all conductors except as noted otherwise.
- .2 Conduit shall be as follows:
  - .1 for interior building surface mounted services greater than 600 volts – rigid galvanized steel;
  - .2 for main distribution wiring in Electrical rooms - rigid galvanized steel with separate insulated ground wire;
  - .3 for exposed conduit outside the building to surface mounted "FS" boxes and for semi-exterior areas such as loading areas - rigid galvanized steel with separate insulated ground wire;
  - .4 for exposed conduit mounted at a height of less than 1200 mm (4') in electrical, mechanical or other service areas - rigid galvanized steel;
  - .5 for short branch circuit connectors to motorized equipment and distribution transformers (minimum length 450 mm (18"), maximum length 600 mm (24") with 180° loop where possible) - galvanized steel flexible liquid-tight conduit;
  - .6 at points, where conductors cross building expansion joints - galvanized steel flexible conduit;
  - .7 for branch circuit conductors underground inside the building, and underground outside the building beneath concrete, asphalt, and similar paving material - rigid PVC with separate insulated ground wire;
  - .8 for branch circuit conductors underground outside the building clear of concrete, asphalt and similar paving material - flexible polyethylene plastic conduit with separate insulated ground wire;
  - .9 for branch circuit conductors in poured concrete slab - rigid PVC with separate insulated ground wire;
  - .10 for interior conduit above 50 mm (2") diameter containing distribution conductors-EMT with separate insulated ground wire;
  - .11 for conductors except as noted above or elsewhere in this Specification or noted on drawings - EMT.

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- .3 Secure conduit located in poured concrete work in place in a manner such that conduit will not float or move when concrete is poured. Adequately protect such conduit from damage prior to and during the concrete pour, and from the concrete and water penetration.
- .4 The maximum allowable size of conduit for installation in poured concrete must be determined in consultation with the Consultant prior to installation. The placement of reinforcing steel in structural concrete work will take precedence over the placement of conduit. Multiple runs of conduit in poured concrete work must be spaced adequately as directed by the Consultant.
- .5 Provide manufactured expansion joints in rigid PVC plastic conduit at spacing as recommended by the conduit manufacturer.
- .6 Install flexible polyethylene conduit in continuous lengths wherever possible and "snake" the conduit in the trench. Where joints are necessary, make same with nylon inserts and stainless steel gear type clamps. Terminate with rigid conduit threadless connectors.
- .7 Provide a separate insulated ground conductor in all conduit.
- .8 Support underground conduit on a well tamped flat bed of earth, free from rocks or protrusions of any kind. Underground conduit must be provided sloping with proper and suitable drainage provisions. Generally, conduit shall slope away from building structure, vaults, manholes, etc., unless means of water drainage are provided to satisfaction of Consultant.
- .9 Support and secure surface mounted and suspended single or double runs of metal conduit at support spacing in accordance with OESC requirements by means of galvanized pipe straps, conduit clips, ring bolt type hangers, or by other proper manufactured devices.
- .10 Support multiple mixed size metal conduit runs with Unistrut Ltd., Electrovert Ltd. "CANTRUSS" or Burndy Ltd. "FLEXIBLE" conduit racks spaced to suit the spacing requirements of the smallest conduit in the group.
- .11 Unless otherwise noted, conduit fittings shall be constructed of the same materials as the conduit and shall be suitable in all respects for the application.
- .12 Provide proper adaptors for joining conduits of different materials.
- .13 Cut square and properly ream all site cut conduit ends.
- .14 Generally, conduit is sized on the drawings. Conduit not sized on the drawings shall be sized in accordance with the latest edition of the OESC. Note that the sizes of branch circuit conductors indicated are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with the voltage drop schedule found on the drawings or obtained from Consultant. Where conductor sizes are increased to suit voltage drop requirements, increase the scheduled or specified conduit size to suit.
- .15 Site made bends for all conduit must maintain the full conduit diameter with no kinking, and conduit finishes must not flake or crack when the conduit is bent.
- .16 Plug ends of roughed-in conduit which are exposed during construction with approved plugs.
- .17 Ensure that all conduit systems which are left empty for future wiring are clean, clear, capped and properly identified at each termination point. Provide end bushing fitting and suitable fish wires in all such conduit.
- .18 Provide empty conduits to ceiling spaces from flush mounted panelboards located below and/or near hung ceiling. Refer to the detail sheet found on drawings.

### 3.3 EXPANSION FACILITIES FOR CONDUIT CROSSING BUILDING EXPANSION JOINTS

- .1 Wherever concealed or surface mounted conduits cross building expansion joints, provide expansion facilities to permit free movement without imposing additional stress or loading upon the support system, and to prevent excessive movement at joints and connections, all in accordance with the detail sheet found on drawings.

**3.4 INSTALLATION OF CABLE TRAY**

- .1 Provide with shop drawings, drawing of proposed layout and routing of the tray, including dimensions, penetrations, connections, supports, etc. Provide sample of tray to Consultant. Provide cable tray for conductors where shown and as required. Exact length requirements shall be site measured. Ground/bond cable tray as per OESC requirements.
- .2 Install and hang the tray at maximum 1.5 m (5') centres and in accordance with the manufacturer's published literature employing a trapeze configuration of Unistrut c-channel hangers secured with threaded rods to ceiling structure. Any cuts to the steel material must be re-finished with corrosion resistant finish.
- .3 Equip the tray with the necessary fittings and similar accessories required. Make provisions in the cable tray where required for conduit entry. Terminate conduits at or in the tray with proper grommetted and bushed terminations. Equip the tray with the necessary wall flanges, dropouts, enclosures, reducers, fittings and similar accessories required, maintaining effective free cross-sectional area of tray clear of all obstructions that might damage conductors insulation during installation.
- .4 The cable tray routing shown on the floor plans is general only and shall be carefully coordinated with the work of other trades. Adjust location or routing as may be required and include for all offsets necessary for coordination.
- .5 Properly secure, adequately support and neatly harness conductors in the tray. Seal cable tray penetrations of building fire barriers by means of ULC listed and labelled packing material. Provide continuous paths along the entire lengths of the cable tray to maintain proper ground continuity. Use manufacturer's hardware to provide continuous paths along the entire lengths of the cable tray to maintain proper ground continuity and bonding.

**3.5 INSTALLATION OF OUTLET BOXES AND BACK BOXES**

- .1 Provide an outlet box or back box for each luminaire, wiring device, telephone outlet, fire alarm system component, communications systems components, and each other such outlet.
- .2 Outlet boxes flush mounted in interior construction, surface mounted in concealed interior locations, and surface mounted in exposed interior locations where the connecting conduit is EMT, shall be stamped and galvanized steel outlet boxes unless otherwise noted.
- .3 Outlet boxes for surface mounted exterior lighting, receptacles, and other device outlets, boxes flush mounted in exterior building surfaces, and boxes mounted in interior device locations where the connecting conduit is rigid, and for boxes in perimeter walls where insulation and vapour barrier is present, shall be "FS" or "FD" Series cast boxes unless otherwise noted.
- .4 Outlet boxes in underground plastic conduit systems shall be rigid PVC plastic outlet boxes unless otherwise noted.
- .5 Outlet boxes for flush floor mounted devices shall be concrete tight formed galvanized steel fully adjustable flush floor boxes. Locate boxes where shown and install in accordance with manufacturers requirements.
- .6 Outlet boxes for special wiring devices, for special equipment and special applications if required, shall be specified hereinafter in other Sections of this Division of the Specification or on the drawings.
- .7 The size and arrangement of outlet boxes shall suit the device which they serve.
- .8 Generally, mounting heights and locations for outlets are indicated on the electrical drawings, however confirm the exact location and arrangement of all outlets prior to roughing-in. Architectural drawings and the Consultant's instructions have precedence over electrical drawing diagrammatic layouts and specified mounting heights and locations.
- .9 Do not install outlet or back boxes "back-to-back" in walls and partitions. Stagger such outlets and seal against noise transmission in accordance with the typical detail found on drawings or at the end of this Section. "Thru-wall" type boxes will not be permitted for any application.

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- .10 Provide blank cover plates over all boxes left empty for future installation of devices. Clearly identify each box as to its intended use to the Consultant's approval. Generally, blank cover plates shall be stainless steel.

### 3.6 INSTALLATION OF PULLBOXES AND JUNCTION BOXES

- .1 Provide pullboxes in conduit systems wherever shown on the drawings, and/or wherever necessary to facilitate conductor installations. Generally, conduit runs exceeding 30 m (100') in length, or with more than three (3) 90 degree bends, shall be equipped with a pullbox installed at a convenient and suitable intermediate accessible location.
- .2 Provide junction boxes wherever required and/or indicated on the drawings.
- .3 Boxes in rigid conduit and EMT inside the building shall be stamped galvanized or prime coated steel.
- .4 Boxes in exterior rigid conduit shall be "Condulet" cast gasketed boxes unless otherwise noted.
- .5 Boxes in plastic conduit shall be rigid PVC plastic boxes.
- .6 All pullboxes and junction boxes must be accessible after the work is completed.
- .7 Accurately locate and identify all concealed pullboxes and junction boxes on "As-built" record drawings.
- .8 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by spray painting the outside of the covers. Paint colours shall be in accordance with the following schedule:
  - .1 lighting - yellow;
  - .2 normal power - blue;
  - .3 essential power - orange;
  - .4 fire alarm - red;
  - .5 telephone - green;
  - .6 miscellaneous signals - brown.
- .9 In addition to painting miscellaneous signal boxes, clearly identify the specific system in which the box is installed.
- .10 Cover boxes in fire rated walls with aluminum tape and seal with caulking.

### 3.7 INSTALLATION OF CONDUCTORS

- .1 Provide all required conductors.
- .2 Conductors, unless otherwise noted, shall be as follows:
  - .1 underground inside or outside the building – "TWU";
  - .2 in accessible suspended ceiling spaces for drops to luminaires and down drops in stud wall construction, and wherever else shown or specified – "AC-90" flexible armoured cable ("BX"); (maximum 6 m (20') run permitted);
  - .3 for all wiring except as noted above or except as specified elsewhere – "T90 Nylon."
- .3 Support "BX" armoured cable in ceiling spaces and in stud wall construction with steel two (2) hole cable straps to "Code" requirements. Run "BX" in ceiling spaces in a neat manner, parallel and perpendicular to building lines.
- .4 Make joints in thermoplastic insulated conductors by means of pressure type twist connectors.

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- .5 Low voltage conductors shall be No. 18 AWG “TEW” except for use in fire alarm system applications and unless otherwise noted. Provide specified fire alarm cables for fire alarm system applications or security system applications as approved by Code and local Governing Authorities.
- .6 Generally, conductor sizes are indicated on the drawings. Such sizes are minimum requirements and must be increased, where required, to suit the length of run and voltage drop in accordance with the conductor voltage drop schedule found on drawings or obtained from Consultant.
- .7 Do not use conductors smaller than No. 12 AWG in systems over 30 volts, unless otherwise noted.
- .8 Do not use conductors smaller than No. 10 AWG for exterior luminaire wiring unless otherwise noted.
- .9 Colour code conductors throughout to identify phases, neutrals and ground by means of self-laminating coloured tape, coloured conductor insulation, or properly secured coloured plastic discs. Colours, unless otherwise noted, shall be as follows:
  - .1 phase A - red;
  - .2 phase B - black;
  - .3 phase C - blue;
  - .4 ground - green;
  - .5 neutral - white;
  - .6 control - orange.
- .10 Control conductors, in addition, shall be numbered with Brady Ltd., Ideal Industries or Electrovert Ltd. Z-type markers.
- .11 Colour code conductors for communications systems in accordance with the system component manufacturer's recommendations.
- .12 When pulling wires into conduit, use lubricant and ensure that wires are kept straight and are not twisted or abraided.
- .13 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- .14 Install all low voltage conductors in conduit unless otherwise noted.
- .15 All conductors not installed in conduit or raceways must be FT insulated rated in accordance with the latest Governing Code flame spread requirements.

### **3.8 INSTALLATION OF SWITCHES AND RECEPTACLES**

- .1 Provide switches and receptacles where indicated on the drawings and as required. Where mounted in control panels, provide samples and/or dimensions of devices to panel manufacturer to ensure proper installation and cutout openings. Coordinate work.
- .2 Switches and receptacles shall be ivory for devices, unless otherwise noted. Refer to drawings.
- .3 Confirm switch and receptacle finishes with Consultant prior to ordering.
- .4 Provide a separate insulated ground wire for all circuits.
- .5 Where receptacles are indicated in laboratory bench splashbacks, a box cutout shall be provided in splash back by bench supplier. Provide device box, receptacle, plate and branch circuit wiring. Branch circuit wiring within benches shall be flexible armoured cable (BX).
- .6 Provide hazardous location switch in Outdoor Storage Room to control room lighting. Surface wall mount were shown.
- .7 Provide self-adhesive label on the faceplate of each receptacle as previously described.

- .8 Ensure that switches located adjacent to doors are located at the strike side of the door. Confirm door swing requirements on the architectural drawings, not on the electrical drawings.

**3.9 INSTALLATION OF FACEPLATES**

- .1 Equip each switch and receptacle with a faceplate with an opening or openings suitable for the device it conceals. Secure faceplates to the device frames with screws to match the faceplates.
- .2 Faceplates for flush mounted switches and receptacles shall be stainless steel.
- .3 Faceplates for surface mounted switches and receptacles shall be galvanized steel.
- .4 Faceplates for weatherproof receptacles denoted "WP" on the drawings shall be weatherproof insulated faceplates with hinged and gasketed receptacle access flaps.
- .5 Confirm the exact material, finish and colour of faceplates for devices in any particular area with the Consultant prior to ordering.

**3.10 INSTALLATION OF SURFACE RACEWAYS**

- .1 Provide surface raceway assemblies complete with all specified and required accessories necessary for a complete electrical raceway system for locations as shown on the drawings. Required quantity of receptacles and outlet provisions shall be as shown on the drawings. Confirm finishes with Consultant prior to ordering. Confirm exact lengths by on site measurements.
- .2 Assemble and secure raceways, boxes and all other components to the surfaces indicated on the drawings in accordance with the manufacturer's instructions and requirements. Connect complete.
- .3 Ends of raceways shall butt to cabinets, counters, etc., where possible. Faceplates shall mount flush onto raceway with no gaps.
- .4 Do not exceed the wire fill requirements given in the manufacturer's instructions.

**3.11 INSTALLATION OF SLEEVES**

- .1 Where conduits, round ducts and conductors pass through structural poured concrete, provide galvanized steel sleeves unless otherwise noted.
- .2 Sleeves in concrete slabs, except as noted below, shall be No. 24 gauge with an integral flange to secure the sleeves for formwork construction.
- .3 Sleeves in waterproof concrete slabs and in other slabs where waterproof sleeves are required shall be lengths of Schedule 40 pipe sized to extend 100 mm (4") above the floor.
- .4 Sleeves in poured concrete walls and foundation shall be Schedule 40 pipe.
- .5 Size sleeves, unless otherwise noted, to leave 13 mm (1/2") clearance around the conduit, duct, conductor, etc. Pack and seal the void between the sleeves and the conduit, duct, conductors, etc., for the length of the sleeves as in accordance with the article entitled "Firestopping and Smoke Seal Materials" specified here in this Section of the Specification. Pack and seal sleeves set in exterior walls with approved materials suitable for application and seal both ends of sleeves watertight with approved permanently flexible and water tight materials.
- .6 Submit drawings indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and shall relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.
- .7 Supply sleeves of a water protecting type in accordance with the detail found on drawings or at the end of this Section for installation in the following locations:
  - .1 in Mechanical and Fan Room floor slabs, except where on grade;
  - .2 in slabs over Mechanical, Fan, Electrical and Telephone Equipment Rooms or closets;



- .3 in all floors equipped with waterproof membranes;
- .4 in the roof.
- .8 "Gang" type sleeving will be permitted only with the approval of the Consultant.
- .9 Terminate sleeves for work which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeve may be covered completely by escutcheon plates.
- .10 All sleeved or formed openings through the structure must be shown on sleeving drawings which are to be submitted to all Consultants for review prior to construction. No holes through the structure will be permitted without written approval of Consultant.

**3.12 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS**

- .1 Where electrical work penetrates or punctures fire rated construction, provide ULC certified, listed and labelled firestopping and smoke sealing packing material systems to seal holes and voids around and within the raceway and to ensure that the continuity and integrity of the fire separation is maintained. Submit certificates of compliance from an independent testing agency, attesting that fire stopping and smoke seal materials meet ULC requirements.
- .2 Examine condition of voids to be filled to ensure suitability for systems. Verify installation of service penetrations and adjacent construction has been completed. Prepare substrates and surfaces to a clean, dry, frost free condition, and primed to firestop system manufacturer's recommendations to receive the firestopping system.
- .3 Install fire stopping and smoke seal materials for each installation in strict accordance with specific ULC certification number and the manufacturer's instructions. Comply with OBC requirements and obtain approvals from local building inspection department. Ensure that openings through fire separations, do not exceed the maximum size wall opening and maximum and minimum dimensions, indicated in ULC Guide No. 40 U19 for Service Penetration Assemblies and fire stopping materials.
- .4 Ensure that the continuity and integrity of the fire separation is maintained and conform to requirements of the latest edition of ULC publication "List of Equipment and Materials, Volume II, Building Construction".
- .5 Work shall be executed by qualified applicator approved by the manufacturer.
- .6 Arrange for manufacturer's authorized representative to inspect and verify each installation and provide a test report signed by Contractor and manufacturer's representative. The test report must list each installation and respective ULC certification and number.
- .7 Copies of ULC certifications must be submitted to Consultant.

**3.13 SUPPLY OF ACCESS DOORS**

- .1 Supply access doors to give access to all junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair but which is concealed in inaccessible construction.
- .2 Before commencing installation of electrical work, prepare on a set of reflected ceiling plans, complete layouts of all ceiling access doors which will be required. Submit these layouts for approval and show the exact sizes and locations of such ceiling access doors. Locate and arrange electrical work to suit.
- .3 Access doors will be installed by the trade responsible for the particular type of construction in which the doors are required. Supply the access doors to the trade installing same at the proper time.
- .4 Access doors shall wherever possible, be of a standard size for all applications. Confirm exact dimensions prior to ordering.

**3.14 INSTALLATION OF FASTENING AND SECURING HARDWARE**

- .1 Provide all fasteners and similar hardware required for conduit, duct, raceway, conductors, etc., and for equipment hanger and/or support material unless otherwise noted.
- .2 Accurately and properly set concrete inserts in the concrete framework. Where multiple type inserts are used, space same to suit requirements of the smallest conduit, etc., in the group.
- .3 Fasten hanger and support provisions to masonry with expansion shields and machine bolts, or, for light loads, use plugs and screws.
- .4 In drywall or plaster walls and/or ceilings use two (2) wing toggles and for heavy loads, provide steel anchor plates with two (2) or more toggles to spread the load.
- .5 Provide beam clamps for attaching hanging and/or support provisions to structural steel, or where approved by the Consultant, weld the hanging and support provisions to the structural steel.
- .6 Explosive powder actuated fasteners will not be permitted unless specific written approval for their use and type has been obtained from the Consultant.
- .7 Under no circumstances use ceiling suspension hangers or grids for suspension of conduit and conductors.
- .8 Provide metal framing channels for support of equipment as shown. Install as per manufacturer's instructions.

**3.15 INSTALLATION OF IDENTIFICATION NAMEPLATES**

- .1 Submit proposed nomenclature, sizing and colours with shop drawing submission.
- .2 For each piece of electrical distribution equipment from the electrical source of supply up to and including panelboards, for special control panels and cabinets, and for each other piece of electrical equipment, provide engraved Lamacoid identification nameplates secured to apparatus with stainless steel screws. Nameplates shall indicate the equipment designation number and the source of electrical supply.
- .3 Equip large multiple cell or component apparatus such as sub-stations, switchboards and distribution panels with main nameplates identifying the equipment, voltage characteristics, capacity and source of supply, and with sub-nameplates clearly identifying each cell or component and its service.
- .4 Nameplates shall identify the equipment number as designated on the drawings, and/or schedule, unless otherwise instructed. Nameplates for disconnect switches, control panels, and cabinets shall outline their service and source of supply.
- .5 Provide identification labels on the outside of each device outlet faceplate, identify the location from where each device is fed. Verify nomenclature with Consultant. Upon completion of work, turn over electronic labelling device to Consultant, for forwarding to Owner. Labels shall not be hand printed.
- .6 Confirm exact nameplate wording, designations, and sizes with the Consultant prior to manufacture. Nomenclature must be in accordance with the Owner's standards.

**3.16 INSTALLATION OF WARNING SIGNS**

- .1 Provide warning signs on all doors into Electrical Room, on pad mount main power transformer and wherever required by local governing authorities.
- .2 Secure the signs to the equipment with stainless steel screws. The number of signs required and the sign wording and colours must be approved by the Utility.

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### **3.17 INSTALLATION OF SYSTEM BACKBOARDS**

- .1 Provide the specified terminal backboards for communication systems and electrical distribution equipment.
- .2 Securely wall mount each backboard in locations as shown on the drawings.
- .3 Ensure that backboards are sized to sufficiently provide adequate termination space for each system plus 20% spare space, as required.

### **3.18 GENERAL ELECTRICAL WORK TESTING**

- .1 In addition to the tests required by the Governing Authorities, codes and regulations, perform the following:
  - .1 after all luminaires, switches, receptacles, motors, signals, etc., are installed, whether same are installed as part of this Section of the work or by other Sections (telephone systems excepted), test all work to ensure that there are no grounds or crosses;
  - .2 establish and ensure proper motor rotation - measure full load running currents and check overload elements - report to the Consultant any discrepancies which are found;
  - .3 demonstrate to the Consultant that branch circuit voltage drop is within the specified units;
  - .4 ensure that all devices are commissioned and operable.

### **3.19 BRANCH CIRCUIT BALANCING**

- .1 Connect all branch lighting and power circuits to panelboards so as to balance the actual loads (wattage) within 5%. If required, transpose branch circuits when the work is complete to meet this requirement.
- .2 At the request of the Consultant, perform all necessary tests to show the above requirement has been fulfilled. Make such tests after the building is occupied.

### **3.20 EQUIPMENT BASES AND SUPPORTS**

- .1 Unless otherwise noted, secure floor mounted equipment in place on 100 mm (4") high concrete housekeeping pads 100 mm (4") wider and longer than the equipment base dimensions.
- .2 Furnish dimensioned drawings, templates and anchor bolts for proper setting of equipment on bases and pads. Be responsible for all required levelling, alignment, and grouting of the equipment.
- .3 Where equipment is suspended above floor level it shall be, unless otherwise noted, supported on a suitable welded or bolted prime coat painted structural steel angles or channels bracketed to the wall or secured by hanger rods.

### **3.21 CONCRETE WORK**

- .1 Provide all concrete required for your work, including formwork and reinforcing steel.
- .2 Concrete shall be minimum 20700 kPa (3000 psi) ready mix concrete provided in accordance with latest editions of CAN/CSA A23.1 "Concrete Materials and Methods of Concrete Construction" and CAN/CSA-A23.2 "Methods of Tests for Concrete."

### **3.22 EXCAVATION AND BACKFILL**

- .1 Provide all excavation, backfill and related work required for your work. Perform such work in accordance with requirements of Division 2, except as modified by this article. Obtain a copy of the soil test report from the Consultant. Examine and understand the soil test report included in Division 2 and structural drawings and details as applicable, during the Bid period.
- .2 Grade the bottom of the excavation as required.

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- .3 In firm, undisturbed soil, lay services directly on the soil. Backfill excess excavation with 13,790 kPa (2,000 psi) concrete.
- .4 Prepare new bedding under the service in unstable soil, in fill, and in all cases where bedding has been removed in earlier excavation, particularly near perimeter walls of buildings, and at manholes and catch basins. Compact to maximum possible density and support the service by means of 200 mm (8") thick concrete cradles spanning the full length between firm supports. Refer to the detail found on drawings.
- .5 Where excavation is necessary in proximity to and below the level of any footing, backfill with 13,790 kPa (2,000 psi) concrete to the level of the highest adjacent footing. Proximity is determined by the angle of repose as established by the Consultant.
- .6 Do not open trenches ahead of installation of services and backfilling more than weather will permit. Break up rocks and boulders and remove by drilling and wedging. Do not use blasting unless specifically approved by the Consultant.
- .7 Before backfilling, obtain approval from Consultant, local governing authority or utility as required. Failure to obtain such approvals of work prior to backfilling will require Contractor to re-excavate work at no additional cost to Owner. Remove all shoring during backfilling.
- .8 Backfill trenches within the building with clean sharp sand in individual layers of maximum 150 mm (6") thickness, compacted to a density of 100% Standard Proctor. Hand compact the first layers up to compacted level of 300 mm (12") above the top of the service. Hand or machine compact the balance up to grade using approved equipment. Final surface toppings shall generally be the responsibility of General Trades. Coordinate exact requirements with General Contractor.
- .9 Backfill trenches outside the building (not under roads, parking lots or traffic areas), up to a compacted level of 450 mm (18") above the service with Granular "A" material, hand compacted to a density of 95% Standard Proctor. Backfill the balance with 150 mm (6") layers of approved excavated material, compacted to 95% Standard Proctor density using approved equipment.
- .10 Backfill trenches outside the building under roads, parking lots or traffic areas with granular "A" material in layers not exceeding 150 mm (6") thickness, compacted to 100% Proctor density up to grade level.
- .11 Fill all depressions to correct grade level with appropriate material, after an adequate period has passed to reveal any settlement. Use maximum possible compaction. Pay all costs required to make good all damages caused by settlement.
- .12 Unless otherwise directed in Division 2, store and dispose of excavated materials as follows:
  - .1 during the progress of the contract, place the material as directed in such a manner that a minimum of damage or disfigurement of the existing ground will result and the material will not in any way impede the progress of the work;
  - .2 separately place surplus topsoil and subsoil as directed, leave the site clean and unencumbered.
- .13 Do pumping as required to keep excavations free of water.
- .14 Before commencement of excavation for your work, determine in consultation with the Consultant, Owner, Municipality and Utilities the presence, if any, of existing underground services at the site. Locate such services and mark out same. Ensure that all trades concerned are aware of their presence.
- .15 Note: You will be held responsible for any damage done to existing underground services caused by your neglect to determine and mark out the location of such services prior to excavation work commencing.
- .16 The inverts and locations of existing site services may have been site surveyed and the approximate location may be shown on the drawings. It is your responsibility to confirm and satisfy yourself that the inverts and locations if/as shown are correct, prior to commencing excavation. Where discrepancies are found, immediately inform the Consultant and await a direction.

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- .17 Where Work falls under the jurisdiction of the local Utility, confirm requirements and comply with Utility requirements.

### **3.23 FINISH PAINTING OF ELECTRICAL WORK**

- .1 Unless otherwise noted, finish painting of exposed electrical work will be done as part of the work of Division 9.
- .2 Touch-up paint pre-finished equipment and provide identification painting of conduit, duct and equipment to the Consultant's approval. Confirm colour requirements prior to ordering.

### **3.24 INSTRUCTIONS TO OWNER**

- .1 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of systems and equipment listed in the trade Sections governed by this Section. Obtain in writing from the Consultant a list of the Owner's representatives to receive instructions.
- .2 Arrange for and pay for the services of qualified service technicians and other manufacturer's representatives required for instruction of specialized portions of the installation.
- .3 Submit to the Consultant prior to application for a Certificate of Substantial Performance of the Work, a complete list of systems for which instructions were given, stating for each system:
  - .1 date instructions were given to the Owner's staff;
  - .2 duration of instruction;
  - .3 names of persons instructed;
  - .4 other parties present (manufacturer's representative, consultants, etc.).
- .4 Obtain the signatures of the Owner's staff to verify that they properly understood the system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "As-built" record drawings.

**END OF SECTION 16050**

## **SECTION 16400 – ELECTRIC SERVICE AND DISTRIBUTION**

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## **SECTION 16400 – ELECTRIC SERVICE AND DISTRIBUTION**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 Section 16010 applies to and is a part of this Section.
- .2 Section 16050 forms a part of this Section and contains requirements, products and methods of execution that apply to this Section.

#### **1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 The following work which is related to the electric service and distribution work is specified in other Sections of the Specification:
  - .1 supply of motor control centres, motor starters and accessories.

#### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings for the following:
  - .1 Transformer pad;
  - .2 transformers;
  - .3 secondary switchboard;
  - .4 panelboards;
  - .5 utility's metering cabinet;
  - .6 automatic transfer switch;
  - .7 enclosed breakers;
  - .8 short circuit and coordination study;
  - .9 push button operators.

#### **1.4 LOCAL ELECTRICAL UTILITY REQUIREMENTS**

- .1 Comply with the latest requirements of the local electrical Utility conditions of supply. Confirm exact requirements with the local Utility and coordinate Utility requirements with the respective Divisions of the Work providing such work. The Utility requirements generally include but are not limited to the following:
  - .1 inspection: on site access for Utility's Inspector to be on duty for duration of work;
  - .2 underground inspection: submission of approval drawings and application for inspection prior to any inspection of work;
  - .3 preconstruction meeting;
  - .4 prior to any underground installations, site must be prepared to within 150 mm (6") of final grade;
  - .5 installation of "DANGER MARKING TAPE" in electrical trenches, within 300 mm (12") of final grade;
  - .6 all work and materials must be approved by Utility's Inspector prior to any backfilling work.

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### 1.5 INCOMING ELECTRIC SERVICE WORK

- .1 Included in Division 1 is a cash allowance to cover the costs for the electrical utility to extend their electrical system to service the property. Their work shall include but not be limited to provision of the following:
  - .1 provide primary conductors and install in ductbank;
  - .2 all required primary connections and secondary connections to main power transformer;
  - .3 provide pad mounted power transformer;
  - .4 provide testing of primary conductors, power transformer and connections;
  - .5 required off site work to incoming system;
  - .6 low voltage metering.

### 1.6 SERIES RATED COMBINATIONS

- .1 Comply with OESC Rule 14-014 with regards to series rated combinations of overcurrent protective devices and ensure that equipment in which the lower rated devices is installed is marked with a series combination interrupting rating at least equal to the available fault current.

### 1.7 BREAKERS

- .1 Breakers shall be NEMA rated types, and for switchboards and distribution panelboards breakers when frame sized 225 amperes and greater, shall be provided with solid state adjustable trip units with Long time, Short time and Instantaneous time (LSI) settings and time delays and be 100% nameplate rated. Provide ground fault alarm as required.
- .2 Breakers shall generally be sized on the drawings, but in absence of direction, size breakers to suit intended application, to suit coordination study requirements and in accordance with OESC.

### 1.8 EQUIPMENT WITHSTAND RATINGS

- .1 Electrical equipment, circuit protective devices, bussing and switches shall be rated to interrupt or withstand short circuit faults greater than the available fault current.
- .2 Refer to notes on drawings and to Part 3 article entitled "Distribution System Testing, Coordination and Commissioning."

### 1.9 SYSTEM START-UP, TESTING, INSPECTION AND COMMISSIONING

- .1 When each system/equipment installation is complete and ready for acceptance, arrange for the system manufacturer or manufacturer's authorized representative to visit the site to:
  - .1 check all component connections and overall installation;
  - .2 program and provide start-up procedures for systems;
  - .3 test and adjust the system and ascertain that the components are as specified;
  - .4 commission system and ensure that devices operate as specified and as designed; commissioning work herein this section, refers to manufacturer's general start-up requirements;
  - .5 verify system component operations;
  - .6 prepare, document and evaluate test results;
  - .7 authenticate test results and signature of authorized testing Engineer/Technician;
  - .8 check and verify nameplates;



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- .9 provide maintenance and operation instructions to Owner's personnel.
- .2 When that system start-up, testing, adjusting and commissioning specified above is complete, obtain from the supplier/manufacture (or where specified, independent inspection company), a test report with test sheets, and covering verification letter signed by authorized testing technician, stating that the system has been inspected and tested, performs as specified and is ready for acceptance. Bind documents under cover and submit minimum four (4) copies to Consultant.

### 1.10 PROVISIONS FOR SUB-METERING SYSTEM

- .1 Division 16 Contractor shall, supply and install a central electronic sub-metering system into the main service entrance switchboard. The system shall meter/monitor the electrical service via interconnection to Division 15 DDC control system.

## PART 2 - PRODUCTS

### 2.1 DUCT AND FISHCORD FOR CONCRETE ENCASED DUCTBANK

- .1 CSA approved, Canron Inc., PVC Type II plastic or FRE Composites Inc., "FRE" fibreglass reinforced epoxy conduit suitable for concrete encasement and in accordance with local Utility requirements.
- .2 Brantford No. 450 plastic twine cord, or 20 mm (3/4") diameter polyethylene rope approved by the Utility.

### 2.2 TRANSFORMER PAD

- .1 Precast concrete transformer pad, as required to accommodate utility's transformer and generally as follows:
  - .1 sized as per transformer requirements and as per details;
  - .2 concrete of minimum strength of 32 MPa which shall be confirmed with transformer manufacturer;
  - .3 steel reinforced;
  - .4 cable openings coordinated with duct bank entry.
- .2 Confirm and coordinate exact requirements with transformer requirements and local electrical utility.
- .3 Acceptable manufacturers subject to approval by local electrical utility are Industrial Cast Stone Ltd., Brooklin Concrete Products Ltd. and Centennial Concrete.

### 2.3 MAIN SECONDARY SWITCHBOARD

- .1 Eaton (Cutler-Hammer) "Pow-R-Line C," 347/600 volt, 3-phase, 4-wire, indoor, metal enclosed, standardized service entrance switchboard for use in a solidly grounded system with a short circuit capacity as scheduled. The switchboard shall be as shown and scheduled on the drawings and shall be manufactured in accordance with the latest editions of EEMAC Standard G8-2 and CSA Standard CAN/CSA C22.2 No. 31, and shall be factory tested in accordance with latest requirements of CAN/CSA C22.2 No. 31. Conform to local Utility requirements.
- .2 Structure:
  - .1 The switchboard shall consist of sections bolted together to form an enclosed, self-contained, self-supporting structure with all necessary facilities for proper ventilation. Each cell shall be of modern welded construction, fabricated from sheet steel in accordance with EEMAC and CSA requirements and reinforced wherever necessary to provide adequate strength. Front panels or doors shall be formed type, fabricated with cold rolled sheet steel. Unless otherwise required, rear, top and side panels shall be secured suitably to a channel type base. After fabrication, switchboard shall be factory cleaned, bonderized, and factory finished with ASA No. 6/491 light grey enamel.

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- .2 The entire enclosure shall be in accordance with EEMAC 2 “drip-proof” requirements. In addition, the top of switchboard shall be complete with a “drip-shield” designed to shed water without dripping on the switchboard. Ventilation louvres shall protect “live” components from penetration of water from activated sprinklers and doors and component openings shall be gasketed.
- .3 Future Cells:
  - .1 Where shown, provide bus terminations for future extensions and gasketed water-tight removable side panels to accommodate installation and connection of future cells.
- .4 Bus Bars:
  - .1 Main bus bars shall be constructed of top quality, 98% pure, rectangular copper bars, silver flashed at all joints with lap type joints bolted using high strength 13 mm (1/2") steel bolts and extra wide, extra thick washers to ensure maximum pressure and even current distribution at each joint. Bus and connections shall be designed so that the maximum temperature rise in any part of the switchboard will not exceed 65°C over an ambient temperature of 40°C. The bus shall be properly isolated and designed to carry the currents as noted.
  - .2 A ground bus not less than 6 mm (1/4") x 50 mm (2") cross section area shall be provided for the length of the switchboard and solidly bolted to the steel framework. The ground bus shall be constructed of the same material as the main bus and shall be complete with suitable lugs for grounding connections outlined on the drawings. The ground bus shall have momentary current rating equal to or greater than that of the apparatus in the switchboard.
  - .3 Supply all required bolts, nuts and washers for field connection of bus joints.
- .5 Control Wiring:
  - .1 Each section shall be complete with all required control wiring and terminal blocks. Control wiring shall be type “SIS,” size No. 14, extra flexible wire with thermoplastic insulation. Control wiring shall be neatly harnessed and suitably secured.
  - .2 Terminal blocks shall be of the pressure type and complete with removable marking strips.
- .6 Switchboard Arrangement & Components:
  - .1 The switchboard cell arrangement and components shall be as detailed on the drawings.
- .7 Voltmeter, Ammeter & Accessories:
  - .1 IQ DP-4000, microprocessor based monitoring and protective digital metering system to provide complete electrical metering and system voltage protection. System shall measure and display voltage, current, frequency and time, and calculate and display kW, kWh, kW demand, ampere demand, kVA, kVA demand, kVA<sub>r</sub> and kVA<sub>rh</sub>. The system shall include adjustable protective alarm features including voltage phase loss, current phase loss, line voltage phase loss, voltage phase reversal, over voltage, under voltage and time delay. A LED six digit display screen shall be provided on the unit. The system shall include required inputs/outputs, contacts, current transformers, potential transformers and control wiring.
- .8 Current & Potential Transformers:
  - .1 Potential transformers shall be of the compartment type and shall incorporate current limiting fuses.
  - .2 Current transformers shall have ratios to suit the application, a mechanical rating equal to the momentary rating of the circuit breakers, and shall be insulated for the full voltage rating of the switchgear.

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- .3 CT's and PT's shall be provided as part of the central metering system specified later in this Section. Coordinate installation and integration work, as required.
- .4 Current and potential transformers for Utility metering will be supplied by the Utility and will be shipped to the switchboard manufacturer's factory for factory mounting and connection.
- .9 Main Breakers:
  - .1 Series "C," frame type as scheduled and as required for application, sized as scheduled, fixed mounted, solid state moulded case circuit breaker with adjustable trip unit and ground fault protection, and with a minimum interrupting capacity as scheduled.
  - .2 The breaker shall be complete with "Digitrip-310" RMS sensing solid state trip unit having the following adjustable tripping functions: long time pick-up, long time delay; short time pick-up; short time delay; instantaneous pick-up; ground fault pick-up; and ground fault delay. Trip settings shall be as determined by the distribution system testing and coordination study specified herein this Section. The tripping unit shall have three (3) sensors, one (1) on each phase conductor, arranged such that a trip signal from any sensor shall open all three (3) poles of the breaker.
  - .3 The breaker shall be ULC listed for application of 100% of its trip setting. The breaker shall be capable of carrying its full rated ampere capacity, indefinitely without tripping.
- .10 Circuit Breaker Distribution Section:
  - .1 Circuit breaker panelboard distribution section shall be Series "C" moulded case, bolt-on circuit breakers with an interrupting capacity as scheduled and frame size to suit application. Breakers frame sized 225A and greater shall be provided with solid state adjustable trip unit as described in Part 1 and be 100% nameplate rated.
- .11 Transient Voltage Surge Suppression:
  - .1 Switchboards shall be complete with integral Surge protection Device (SPD). The SPD unit shall be factory installed and connected onto bussing through integral disconnect as recommended by manufacturer. The unit shall include diagnostic package with status indicators on each phase, LCD monitoring display and Form C alarm contacts. The SPD features shall be as follows:
    - .1 in accordance with IEEE C62.41, C62.45, UL 1283, UL 1449 and CSA Standards;
    - .2 peak surge current 160 KA per phase;
    - .3 warranty: standard manufacturer's minimum 5 years parts and labour warranty;
    - .4 flush mounting into switchboard enclosure
- .12 Incoming & Outgoing Conductor Connection Facilities:
  - .1 All required facilities and hardware including cubicle for incoming ductbank feeder, and outgoing cable in conduit feeders shall be provided for the switchboard as shown and scheduled.
- .13 Mimic Bus & Nameplates:
  - .1 Red, single line vinyl bus approximately 3 mm (1/8") thick x 9 mm (3/8") wide, representing internal bussing and components shall be riveted to the front of the switchboard and shall extend through the handles of the respective breakers. Engraved Lamacoid nameplates shall be secured with stainless steel screws, adjacent each panel component and identifying each component.

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- .14 Accessories:
  - .1 The switchboard shall be complete with Manufacturer's standard accessories, spare parts and maintenance tool kit.

- .15 Acceptable Manufacturers:

- .1 Eaton (Cutler-Hammer), Schneider Electric (Square D) and Siemens Electric.

### 2.4 UTILITY'S METERING CABINETS

- .1 Surface wall mounting, sprinkler proof, EEMAC 2, enamelled steel meter cabinets complete with gasketting, front viewing shatter-resistant window to allow reading of meter, meter base sockets and padlocking provisions, in accordance with the Utility's requirements. The cabinet must be approved by the local Utility.
- .2 Conduit and fish cord will be provided in accordance to the requirements of the Utility.

### 2.5 DISTRIBUTION TRANSFORMERS

- .1 Hammond Manufacturing Co. Ltd., dry type transformers as per the drawing schedule, constructed and factory tested in accordance with the latest requirements of CSA Standard C9-M1981, "Dry Type Transformers", CAN/CSA C22.2 No. 47-M90 (R2007) and as per CAN/CSA-C802.2-00 with regards to minimum efficiency values.
- .2 The transformers shall be complete with:
  - .1 an EEMAC 2 "drip-proof" enclosure with a rigid end frame, removable gasketed front and rear plates, and a terminal compartment located at the bottom of the enclosure;
  - .2 class "H" silicone type coil insulation, such that the winding temperature rise will not exceed 150°C and the enclosure temperature rise will not exceed 65°C under full load in a 40°C. ambient temperature;
  - .3 factory painted drip shield.
- .3 Each transformer shall also be complete with:
  - .1 K factor 13 rating as per ANSI/IEE C57-110-1986;
  - .2 copper windings;
  - .3 core construction consisting of stacked laminations of high permeability silicone steel;
  - .4 lugs or pressure type terminals to suit primary and secondary conductors;
  - .5 four (4) 2-1/2% full capacity taps, two (2) above normal and two (2) below normal;
  - .6 electrostatic shielding;
  - .7 an integral vibration dampening system;
  - .8 a factory painted ASA No. 61 light grey enamel finish;
  - .9 an aluminum nameplate indicating impedance rating, weight, connection diagram, style and serial number, riveted to the front of the enclosure.
- .4 Acceptable manufacturers are Hammond Manufacturing Co. Ltd., Schneider Electric (Square D), Siemens Electric (Delta Group), Delta Group and REX transformers.

### 2.6 DISTRIBUTION PANELBOARDS

- .1 Eaton (Cutler-Hammer) "Pow-R-Line 4," factory assembled dead front panelboards as per the drawing schedule, manufactured to CSA Standard C22.2 No. 29.

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- .2 Type circuit breaker distribution panelboards shall be single or double row as required and complete with moulded case, bolt-on circuit breakers calibrated for 40°C (104°F) ambient temperature and conforming to CSA Standard C22.2 No. 5 (Note No. 1). Both main lugs and neutral bar shall be located at the same end. Main lugs shall be shielded by a removable cover. Each circuit breaker shall be identified adjacent the breaker handle. Breakers frame size 225A and greater shall be provided with solid state adjustable trip units and be 100% nameplate rated.
- .3 Panelboard boxes shall be constructed of code gauge galvanized steel and shall be complete with removable ends and wiring gutter space on all sides in accordance with CSA requirements.
- .4 Floor mounted enclosures shall be free-standing type, reinforced as required to provide adequate strength.
- .5 Enclosures shall be EEMAC 2 sprinkler-proof, complete with drip shield. Enclosures and drip shields shall be factory painted in ASA No. 61/ 49 grey enamel.
- .6 Distribution panelboards surface mounted in secure areas shall not require doors. Panelboards located in insecure areas shall be complete with doors, latches, and keyed alike locks.
- .7 Bus shall be hard drawn electrical grade copper, silver plated and shall extend to full capacity of panel.
- .8 Distribution panelboards must be supplied with a minimum of 25% space capacity to accommodate future breakers, and complete with bussing for full panel size, and where spare breakers are scheduled, the breakers with required connector kits.
- .9 Distribution panelboards where scheduled shall each be equipped with a main breaker, factory mounted in a barriered section and cable connected to panelboard bus.
- .10 Acceptable manufacturers are Eaton (Cutler-Hammer), Schneider Electric (Square D) and Siemens Electric.

### 2.7 BRANCH CIRCUIT PANELBOARDS

- .1 Eaton (Cutler-Hammer), factory assembled dead front panelboards as per the drawing schedule, manufactured to CSA Standard C22.2 No. 29 and the "OESC," and designed for sequence phase connection of branch circuit breakers.
- .2 Panelboards as scheduled, shall generally be of the following types:
  - .1 "Pow-R-Line 1," 120/208 volt, 3-phase panelboards with, bolt-on moulded case circuit breakers with an interrupting capacity of 10,000 amperes symmetrical at 208 volts, unless otherwise noted;
  - .2 "Pow-R-Line 2" 347/600 volt, 3-phase panelboards with minimum "GBH" frame, bolt-on moulded case circuit breakers with an interrupting capacity as scheduled or in absence of direction shall be of capacity for intended application to OESC requirements.
- .3 Where specified and/or scheduled on the drawings, breakers shall be ground fault, CSA Class "A," Group 1, combination thermal magnetic circuit breakers solid-state ground fault interrupters.
- .4 Panelboards shall be complete with:
  - .1 an EEMAC 2 sprinkler-proof box constructed of code gauge galvanized steel with removable box ends, wiring gutter space on all sides;
  - .2 trim for flush or surface wall mounting as shown, constructed of code gauge steel, and complete with hinged doors with concealed fasteners, concealed hinge, chrome plated door latch and keyed alike lock with key, a steel frame holder and circuit directory card protected by clear acetate and secured to the back of the door, and Mylar circuit breaker identification strips; doors and trim shall be factory finished with ANSI-61/49 grey baked acrylic enamel
  - .3 hard drawn electrical grade copper bus, extending for full capacity of panel;

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- .4 high strength, set screw type, anti-turning wire connectors;
  - .5 ground bus constructed of the same material as the standard bus;
  - .6 drip shields for surface mounted panelboards;
  - .7 200% capacity neutrals for panelboards as scheduled;
  - .8 spaces and spare breakers as scheduled, complete with bussing for full panel size and where future breakers sizes are schedules, the required breaker connector kits.
- .5 Circuit breakers connected to dedicated devices shall be complete with handle lock devices.
  - .6 Surface mounted panelboards shall be factory finished in ANSI-61/ 49 grey baked acrylic-enamel finish.
  - .7 Acceptable manufacturers are Eaton (Cutler-Hammer), Schneider Electric (Square D) and Siemens Electric.

### 2.8 LOW VOLTAGE DISTRIBUTION WIRING

- .1 Conductors as specified in Section 16050.

### 2.9 CONTACTORS

- .1 CSA approved, factory assembled, magnetic, full voltage contactors, Series A201 non-reversing type for heating and motor loads, and Series A202 for lighting loads. Each contactor shall be suitable in all respects for the application and complete with an enclosure with the necessary accessories. Enclosures shall be sprinkler-proof. The ampere rating, number of poles, etc. for contactors shall be as noted on the drawings.
- .2 Equip each contactor with “hand-off-auto” switch and pilot light.
- .3 Acceptable manufacturers are Rockwell Automation (Allen-Bradley), General Electric Co., Eaton (Cutler-Hammer) and Schneider Electric (Square D).

### 2.10 SPLITTER TROUGH

- .1 CSA approved splitter trough, each complete with a formed, factory primed and painted, sprinkler proof steel box with knockouts, hinged front coverplate, suitable mounting provisions, and a nameplate giving its rating.
- .2 Terminal blocks shall consist of pressure type main lugs and branch lugs approved for copper wiring and mounted on porcelain bases.
- .3 Splitter trough ratings shall be as scheduled on the drawings.
- .4 Acceptable manufacturers are Bel Inc., Hydrel and Pursley Inc.

### 2.11 DISCONNECT SWITCHES

- .1 Eaton (Cutler-Hammer), heavy duty, CSA approved, front operated with a handle suitable for padlocking in the “OFF” position and arranged so that the enclosure cover cannot be opened while the handle is in the “ON” position. Operating mechanisms shall be quick-break, positive acting with visible blades and a line terminal shield. Fusible units shall be complete with fuse clips suitable for HRC fuses, unless otherwise noted. The ampere rating, number of poles and fuse requirements shall be as indicated on the drawings. Enclosures shall be factory painted in ASA No. 61 grey enamel finish.
- .2 Disconnects for variable speed drives shall be suitable for use with such drives and include auxiliary switch/contact to de-energize the control power circuit, as required and as applicable.
- .3 Acceptable manufacturers are Eaton (Cutler-Hammer), Schneider Electric (Square D), and Siemens Electric.

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### 2.12 FUSES

- .1 Unless otherwise indicated, fuses shall be English Electric Ltd., Form I, Class "J" HRC fuses for constantly running equipment, and Form II, Class "C" fuses for motor equipment that cycles "ON" and "OFF".
- .2 Acceptable manufacturers are English Electric Ltd., Ferraz Shawmut Co., Noram and Bussmann.

### 2.13 MOTOR STARTER PANELS

- .1 Minimum No. 14 gauge sheet steel panels complete with steel angle reinforcing, framing and suitable splitter trough, all fully primed and enamel painted, sized to accommodate the starters required with spare space and capacity for at least two (2) additional units.

### 2.14 ENCLOSED CIRCUIT BREAKERS

- .1 Eaton (Cutler-Hammer), moulded case, front operated, non-automatic circuit breakers sized as specified on the drawings, each secured in a gasketed "sprinkler-proof" EEMAC 2 wall mounting enclosure with steel front panel and arranged so that the circuit breaker can be padlocked in either the ON or OFF position.
- .2 Eaton (Cutler-Hammer), moulded case, front operated, automatic circuit breakers sized as specified on the drawings, each secured in a gasketed "sprinkler-proof" EEMAC 2 wall mounting enclosure with steel front panel.
- .3 For breakers as required, provide mechanical Kirk Key operator interlocked in a manner to suit application as shown and/or directed by Consultant.
- .4 Acceptable manufacturers are Eaton (Cutler-Hammer), Siemens Electric Ltd. (ITE), Schneider Canada (Federal Pioneer and Square D).

### 2.15 PUSHBUTTONS OPERATORS

- .1 Allen-Bradley Canada Ltd., 800T Series, 55 mm diameter red mushroom head pushbutton with shroud, thrust washer, and an aluminium faceplate with "EMERGENCY POWER OFF" identification lettering or other nomenclature as required to suit application.
- .2 Series 800T, illuminated pilot lamps, red/green colours as required to suit application.
- .3 Key operated.
- .4 EEMAC 2 box for surface mounting applications, CSA approved for application and of size suitable for mounting of devices.
- .5 Enamel painted steel or stainless steel faceplate for flush mounting onto recessed wall boxes or in millwork, suitable for mounting of devices.
- .6 Exact type and ratings of devices shall suit application.
- .7 Acceptable manufacturers are Allen-Bradley Canada Ltd., Eaton (Cutler-Hammer), Square D and GE.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS FOR UTILITY'S INCOMING SERVICE

- .1 Coordinate and arrange for the local electrical Utility to provide their incoming service work.
- .2 Perform the following work to accommodate the Utility's incoming service:
  - .1 provide ducts and concrete encased duct bank as shown;
  - .2 provide secondary feeders and make required connections;
  - .3 provide grounding system as specified and as required for the Utility's equipment;

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- .4 provide metering cabinets and empty conduit between cabinets and metering section of switchboard;
- .5 make all required arrangements with the Utility, perform all required work, and obtain all permits and certificates in order that the electric service is put into operation at the required time.

### **3.2 INSTALLATION OF TRANSFORMER PAD**

- .1 Provide specified transformer pad and foundation in accordance with local Electrical Utility's requirements, in location as shown and as detailed on drawings. Coordinate required excavation, backfill and concrete work. Arrange and coordinate work to prepare ground to provide a level and good draining foundation for the pad and transformer. Coordinate cable entry opening with location of duct bank.
- .2 Installation shall be in accordance with local electrical Utility's requirements and with generally accepted trade practices. Exact requirements must be confirmed with Utility.
- .3 Work must be performed under the general supervision of the General Contractor.

### **3.3 INSTALLATION OF DUCT FOR CONCRETE ENCASED DUCTBANK**

- .1 Provide all required ducts and concrete encasement shown, in accordance with Utility's requirements. Coordinate work with trades responsible for performing excavation, backfill and concrete work. Confirm any requirements with Utility. Provide ducts for incoming telephone and CATV services as shown. Refer to Section 16050 for additional excavation, concrete and backfilling work.
- .2 Standard duct lengths and fittings shall be used as much as possible. When cutting is necessary, duct ends shall be carefully tapered with special field tapering machine. Joints shall be made by means of standard couplings. Minimum bending radius of 1 m (3') shall be maintained.
- .3 Concrete encased duct joints shall be made with the use of couplings which provide a smooth water-tight joint between ducts, using a suitable cement that is specifically designed for use with the duct pipe being used.
- .4 Ducts shall be separated by means of plastic 75 mm (3") spacers and placed 75 mm (3") away from wooden forms on both sides ensuring that there is 75 mm (3") of concrete between ducts and a 75 mm (3") concrete envelope around duct assembly. Elevations and slopes of ducts shall be as shown, or based on minimum 760 mm (30") below finished grade and minimum 1% slope. Ducts shall be separated with spacers at distance as required by local authority and as per duct manufacturers' instructions. Spacers of vertical rows of ducts shall not be located directly above each other. Maintain minimum 150 mm (6") separation. Where ducts cross roads, paved areas, disturbed ground, new or future, concrete envelope shall have 15 mm (5/8") diameter reinforcing steel bars laid longitudinally along trench with 100 mm (4") lateral spacing and 50 mm (2") above base of concrete. An overlap of 600 mm (2') on the reinforcing bars shall be provided where necessary. Reinforcing shall extend 1.5 m (5') beyond backfilled areas, driveways, roadways etc. Duct runs shall also be reinforced at all building entries for a distance of 1.5 m (5') out from such entry walls, the bars being embedded in the walls.
- .5 No concrete shall be placed around ducts, and no backfilling shall be done until duct line is inspected and approved by the Consultant. If concrete is poured around ducts or if trenches are backfilled before ducts have been approved, the Contractor will be required to remove and replace at no extra cost to allow for approval inspections.
- .6 When the conduit has been laid and the duct banks work completed and set, a steel test mandrel shall be drawn through each duct in the presence of the Consultant. The diameter of the mandrel shall be 13 mm (1/2") less than the inside diameter of the duct. Any obstruction found in the duct must be removed to the satisfaction of the Consultant, and the duct system left completely clear. No conduit will be accepted as being ready for installation of the high voltage feeders until this is done.



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- .7 Whenever work is suspended, the ends of ducts shall be protected by means of suitable plugs and such plugs shall be left in use as long as may be necessary. When conduit is installed for future extension the ducts shall be plugged and the end of the duct bank boxes for protection.
- .8 Defective ducts must not be laid under any circumstances.
- .9 Include for provision of the following requirements:
  - .1 all concrete used for encasing ducts shall have a minimum compressive strength of 20 mPa;
  - .2 the bottom of the trench shall be compacted and covered with a freshly poured concrete bed 75 mm (3") thick, for the full width of trench;
  - .3 the lowest row of ducts shall be laid on the concrete bed and completely enclosed in concrete - subsequent layers shall be installed in a similar manner - the ducts shall be spaced 150 mm (6") centre to centre both vertically and horizontally and all spaces between the ducts are to be filled with concrete;
  - .4 the ducts must be enclosed in a 75 mm (3") thick envelope of concrete for the full width of the trench;
  - .5 the entire space between the ducts of the conduit is to be filled with concrete - concrete which has started to set to a point that it will not properly pour to smoothly fill the spaces between and around the ducts shall not be used;
  - .6 use of the monolithic method (i.e. placing all ducts and pouring concrete around the complete installation) is subject to the approval of the Consultant and/or Utility;
  - .7 care should be exercised by the Contractor when placing concrete around the ducts to ensure that the ducts remain in the correct position with proper spacing and that no concrete enters any of the ducts;
  - .8 where duct crosses filled or disturbed ground it shall be reinforced;
  - .9 there must be no metallic reinforcing rods or other conducting material encircling a single conduit in a duct bank (entire duct bank may be encircled);
  - .10 maximum size of aggregate in concrete - 10 mm (3/8");
  - .11 reinforcing rods and dowels in ductbank at building wall as detailed;
  - .12 provide warning tape above ductbank and any other safety markings and provisions as required by governing authorities.
  - .13 provide sloping and drainage of ducts to prevent pooling of water within ducts; coordinate exact requirements with Consultant prior to start of Work;
  - .14 unless drainage provisions have been provided within building for duct draining, seal openings where ducts enter building with elastomeric, fire rated, waterproof sealing material to prevent egress of water and that can easily be removed for access to ducts.
  - .15 provide warning tape above ductbank and any other safety markings and provisions as required by governing authorities.
- .10 Provide one (1) continuous length of polyethylene rope or Brantford twine in each duct indicated as spare or for future use.
- .11 The Consultant and/or a Utility's representative must be given opportunity to witness work.
- .12 Refer to requirements of ductbank detail.

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### **3.4 INSTALLATION OF MAIN SECONDARY SWITCHBOARD**

- .1 Provide main secondary switchboard in the Electrical Room where required, on concrete pad.
- .2 Assemble the individual sections of the switchboard in accordance with the manufacturer's recommendations and instructions, and secure the assembly to the concrete base. Ensure that all bus joint bolts are torqued to the manufacturer's prescriptions.
- .3 Coordinate delivery and installation of utility supplied metering transformers.
- .4 Arrange for the switchboard manufacturer to provide all necessary drawings for erection and installation of the switchboard. In addition, if required, obtain from the manufacturer all necessary copies of detail, erection, etc., drawings required for approval of the installation from the Utility and any other authority having jurisdiction. Obtain all required approvals.
- .5 Install controls and displays at height of between a minimum 1200 mm (4') to a maximum of 1800 mm (6') above finished floor level. Coordinate installation of central metering system CT's/PT's, as required.
- .6 Refer to the distribution testing and coordination study article hereafter in this Section.
- .7 The switchboard shall be arranged as indicated on the drawings.
- .8 Make all necessary incoming and outgoing power cable connections to the equipment in strict accordance with the equipment and cable manufacturer's recommendations. Ensure all connections, stress cones and terminations are suitable for specific incoming and outgoing cables.
- .9 Include in your Bid Price, for the switchgear manufacturer's personnel to provide inspection and testing of the switchgear prior to energizing the system. Refer to the distribution system testing and coordination study article hereinafter in this Section.

### **3.5 INSTALLATION OF UTILITY'S METERING CABINETS**

- .1 Provide approved metering cabinets and conduit and install in accordance with Utility requirements. Install cabinet in locations as shown on the drawings. Provide all required supporting hardware. Extend empty conduit from cabinets to metering compartments of the switchboard or to main disconnect as shown.
- .2 Coordinate the installation with the Utility who will install meter equipment, and connect from the meters to the metering compartments of the switchboard. Confirm exact location of metering cabinet with Utility.

### **3.6 INSTALLATION OF DISTRIBUTION TRANSFORMERS**

- .1 Provide distribution transformers where shown and as required, and connect complete.
- .2 Secure transformers 75 KVA and larger to a concrete housekeeping pad on Vibro-Acoustics Ltd. type "RSR" vibration isolation pads.
- .3 Secure the transformers smaller than 75 KVA in place on an angle wall mounting bracket support assembly located approximately 300 mm (12") below the ceiling. Provide each support assembly and adequately secure to wall and/or ceiling construction.
- .4 Ensure that the transformers are equipped with lugs or connections suitable for the primary and secondary connections indicated. Isolate primary and secondary connections from the transformer enclosures by means of 300 mm (12") to 450 mm (18") of liquid-tight flexible conduit.
- .5 When installation is complete, test and check the secondary voltages. Make all required adjustments and furnish to the Consultant a written report indicating the secondary voltage readings and any adjustments made to achieve the proper voltages. Furthermore, when the building is in normal use, re-check the voltages and make any required adjustments.

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### **3.7 INSTALLATION OF DISTRIBUTION PANELBOARDS**

- .1 Provide distribution panelboards where shown on the drawings and as required, and connect complete. Refer to schedules found at end of this Section or on the drawings.
- .2 Install floor mounted panelboards on concrete housekeeping pads. Surface wall mount other panelboards, unless otherwise noted, independent of connecting conduit.
- .3 Equip each panelboard with suitable lugs to accommodate main and branch conductors scheduled.

### **3.8 INSTALLATION OF BRANCH CIRCUIT PANELBOARDS**

- .1 Provide factory assembled branch circuit panelboards as required and as indicated on the schedules found at end of this Section or on the drawings.
- .2 Support cabinets and enclosures independent of connecting conduit, and accurately install with reference to wall finishes.
- .3 Equip panelboards with suitable lugs or provisions to accommodate the main and branch conductors scheduled.
- .4 Turn over to the Consultant, prior to application for a Certificate of Substantial Performance of the Work, a quantity of a three (3) keys for each panelboard cabinet or enclosure. All branch circuit panelboards shall be keyed alike.
- .5 Where two (2) or more panelboards are installed in one (1) cabinet, equip the panelboards with double lugs and increase gutter capacity to accommodate additional cabling.
- .6 Connect main breakers to emergency power off pushbuttons for panelboards as scheduled.
- .7 Identify all panelboard breakers in a permanent manner, and complete panelboard circuit directories to the Consultant's approval. Use Owner's actual room names/numbers. Provide copies of directories in maintenance manuals.
- .8 Upon completion of the installation of the ground fault breakers, demonstrate in the presence of the Consultant that all protected circuits will "trip" when a simulated ground fault is applied to the "load" side of each circuit breaker/ ground fault interrupter combination. Megger the load side neutral on all GFI protected branch circuits to ensure that the neutral is not grounded on the load side on the GFI. Verify the GFI operation with a temporary load (100 watt lamp in an insulated socket with pigtail leads). Provide a written report confirming that all tests have been performed and that the system is functioning properly.

### **3.9 INSTALLATION OF LOW VOLTAGE DISTRIBUTION WIRING**

- .1 Provide all required distribution wire and cable. The conductors, unless otherwise noted, shall generally be as per branch circuit wiring requirements as specified in Section 16050 and shall be installed in conduit.
- .2 Provide all required cable support system accessories which are not specified herein or shown on the drawings but are required for proper installation.

### **3.10 INSTALLATION OF CONTACTORS**

- .1 Provide contactors in enclosures for electric heating and outside lighting control as shown on the drawings and connect complete. Identify each contactor enclosure.
- .2 Wall mount each enclosure independent to the panelboard to which the loads are connected.

### **3.11 INSTALLATION OF SPLITTER TROUGH**

- .1 Provide splitter trough wherever shown and/or specified on the drawings and as required, including starter schedule drawings.
- .2 Secure splitter trough in place independent of connecting conduit. Connect complete.

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### 3.12 INSTALLATION OF DISCONNECT SWITCHES

- .1 Provide safety switches (disconnects) as follows:
  - .1 wherever shown on the drawings and/or specified herein;
  - .2 wherever required by starter schedule drawings;
  - .3 for motorized equipment which cannot be seen from the motor starter location or is more than 9 m (30') from the starter location;
  - .4 for all "packaged" equipment fed from a motor starter panel.
- .2 Ensure that enclosures for safety switches located outside the building are EEMAC 3. All other enclosures shall be EEMAC 2, sprinkler proof, unless otherwise noted.

### 3.13 INSTALLATION OF FUSES

- .1 Provide a complete set of fuses for each fusible disconnect, motor starter, and similar fusible equipment provided or supplied by you.
- .2 Supply three (3) spare fuses of each size and type used on the project, mount the fuses on a painted and identified plywood rack, and secure the rack in a location where later directed.

### 3.14 INSTALLATION OF PUSHBUTTON OPERATORS

- .1 Provide specified and suitable pushbutton operators and pilot lamps to suit various applications as required.
- .2 Where flush mounted, provide faceplate for mounting onto recessed boxes.
- .3 Where surface mounted, provide suitable EEMAC 2 box.
- .4 Install devices in accordance with manufacturer's instructions to suit application requirements of Owner. Connect complete to respective equipment being controlled. Provide required wiring in conduit.
- .5 Test and verify operation of each device. Provide engraved lamacoid nameplate.

### 3.15 INSTALLATION OF ENCLOSED CIRCUIT BREAKERS

- .1 Provide surface wall mounted, enclosed, circuit breakers for equipment where shown on the drawings. Connect complete as indicated. Interconnect and interlock Kirk Key operators as required.
- .2 Confirm exact locations prior to roughing-in.
- .3 Provide a lamacoid identification nameplate for each enclosure. Confirm exact nomenclature with Consultant prior to manufacturer.

### 3.16 GROUNDING AND BONDING

- .1 Do all required grounding and bonding work in accordance with the drawings and in accordance with requirements of governing authorities, including the OESC. Provide Utility's grounding requirements for the Electrical Room and all equipment under their governing jurisdiction.
- .2 Provide a ground electrode directly under the pad mounted main power transformer consisting of but not limited to a minimum of four (4) ground rods driven into the grade in a square arrangement, at 3 m (10') spacing and interconnected with minimum No. 3/0 bare copper conductor. Ground rods shall be a minimum 20 mm (3/4") diameter copper rods of minimum 3 m (10'). Confirm exact grounding requirements with local utilities at the time of installations.

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- .3 Provide a ground electrode in Electrical Room consisting of but not limited to a minimum of four (4) ground rods driven into the grade in arrangement as shown, at 3 m (10') spacing and interconnected with minimum No. 3/0 bare copper conductor. Ground rods shall be a minimum 20 mm (3/4") diameter copper rods of minimum 3 m (10') length.
- .4 Provide 10 mm x 50 mm x 900 mm (3/8" x 2" x 36") electrical grade copper ground bus in the Electrical Room, 300 mm (12") above finished floor level. Secure the ground bus on 20 mm (3/4") standoff insulators.
- .5 When the buses are in place and all bolts have been tightened and all lugs have been installed, coat the entire installation with two (2) 100% covering coats of suitable shellac to prevent the bus from oxidizing.
- .6 Connect Electrical Room ground grid with ground bus with minimum 3/0 copper ground conductor in conduit.
- .7 Provide minimum No. 3/0 insulated ground wire from the electrical room ground bus to the switchboard, structure, floor, etc., as shown and as required. Extend ground conductor to incoming water service and connect ground conductor to street side metal piping of water meter.
- .8 Throughout the complex, solidly ground the system and make all required grounding connections to all electrical devices and apparatus. Ground conductors shall be insulated copper wire connected with approved fittings in accordance with the OESC. Provide separate insulated ground wire for all circuits.
- .9 All ground connections is slab or buried underground shall be made using welded copper connections, "Cadweld" as supplied by Erico Products or compression lugs "Hyground" supplied by Burndy Ltd.
- .10 Provide minimum No. 3/0 AWG copper grounding conductors and 600 mm x 50 mm x 10 mm (24" x 2" x 3/8") copper ground bus mounted on wall with 19 mm (3/4") standoff isolators and eight (8) drilled taped holes, in each LAN room. Connect the 3/0 ground from each ground bus to building ground system in the main electrical room. Bond each data equipment rack to local ground bus with minimum No. 6 AWG insulated ground wire.
- .11 Do not pour concrete until all grounding conductors and grounding connections to be embedded in the concrete, are inspected and approved by ESA and the Engineers.
- .12 Service conductors exceeding 400 amperes shall be provided with minimum no. 3/0 AWG grounding conductor, unless otherwise noted.
- .13 Provide ground conductors as sized on drawings and in accordance with Codes and Standards requirements, but which shall be of size no smaller than the requirements specified herein this article or on the drawings.
- .14 Provide grounding and bonding requirements for telecommunication systems as specified in Section 16750.

### 3.17 ELECTRICAL CONNECTIONS FOR MECHANICAL, OWNER'S, ETC., EQUIPMENT

- .1 In addition to providing electrical feeders and connections to equipment provided by Division 16, provide all required electrical connections to apparatus provided and/or supplied by Division 15, the Owner and as part of other Divisions of the Specification.
- .2 Unless otherwise noted, provide electrical connections including power and control wiring for equipment supplied by the Owner or by other Divisions, and except for control wiring of Section 15900 of Division 15. Where shown on the drawings and as required, provide complete wired and empty conduit systems with fish cord, with minimum diameters as sized on the drawings and junction boxes, pull boxes, outlet boxes, faceplates, sleeves, etc., as required. Provide disconnect switches, receptacles and all other required wiring and connection accessories. Coordinate work with the respective Consultants and suppliers of the equipment to be provided with electrical connections.

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- .3 Coordinate with trades of other Divisions to ensure provision of proper electrical requirements. Unless otherwise noted or directed by Consultant, be responsible for provision of interconnect wiring between remote operator devices, controllers and equipment being controlled by the operator devices, whether or not such devices/controllers are supplied by Division 16. Provide disconnect switches, receptacles and all other required wiring and connection accessories. Provide system/equipment power feeds with hard wired or receptacle type connections, as required. Coordinate exact requirements prior to start of work, at time of shop drawing submissions and prior to roughing-in of work. Coordinate with the suppliers of the equipment to be provided with electrical connections.
- .4 Division 15 will supply all starters and variable speed drives for motorized apparatus supplied by them and will provide Lamacoid identification throughout. Motor control centre, motor starter and variable speed drive requirements shall be as scheduled on the sheets found at the end of this Section or on the drawings. Starters generally will be supplied in the following manner:
  - .1 loose starters for mounting adjacent to apparatus or on motor starter panels;
  - .2 mounted starters on factory assembled and pre-wired packaged equipment;
  - .3 mounted starters on factory assembled and pre-wired motor control centres.
- .5 Motor control centres will be supplied and set in position by Division 15.
- .6 Install variable speed drives in strict accordance with the manufacturer's instructions. Provide manufacturer's recommended conductors and connectors to suit the variable speed drives. Maintain separation of power and control conductors as per manufacturer's requirements to minimize effects of electromagnetic interference. Properly ground equipment.
- .7 Be responsible for:
  - .1 mounting loose starters/variable speed drives and providing "line" and "load" power connections;
  - .2 providing motor starter panels - conduit work at motor starter panels must be horizontally and vertically plumb and the installation shall be planned to avoid crossovers;
  - .3 making "line" side power connections to starters/variable speed drives on "packaged" equipment;
  - .4 making "line" side power connections to motor control centres and "load" side connections to motors or other apparatus supplied power from motor control centres;
  - .5 coordinating feeder entries to starters and starter assemblies with Division 15;
  - .6 providing additional disconnect switches complete with identification detailed on the drawings, or required by Code, or for apparatus which cannot be seen from its starter or is in excess of 9 m (30') from its starter;
  - .7 connections to thermistors and provision of additional relays as required for connections to starters; generally, Division 15 shall supply required specifications and/or drawings defining these requirements and include necessary work, wiring, conduit and components not being supplied by Division 15;
  - .8 performing all required motor starter interlocking in accordance with requirements specified and as outlined on the starter schedule drawings - equip each starter to be interlocked with all required control connection accessories; coordinate exact requirements with Division 15;
  - .9 providing an identification nameplate on each motor starter, variable speed drive or disconnect;
  - .10 providing an identification nameplate on each motor control centre - the nameplate shall give the name, for example, MCC No. 1, and the voltage, for example, 600 volts;

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- .11 providing and attaching with stainless steel screws to each separately mounted 3-phase motor starter or group of 3-phase motor starters a suitably sized black-white-black Lamacoid nameplate engraved to read:
- “MOTOR(S) IS CAPABLE OF MAKING TWO (2) STARTS IN SUCCESSION, COASTING TO REST WITH APPROXIMATELY 15 MINUTES ELAPSED TIME BETWEEN STARTS, WITH THE MOTOR INITIALLY AT AMBIENT TEMPERATURE, OR OF MAKING ONE (1) START WITH THE MOTOR INITIALLY AT A TEMPERATURE NOT EXCEEDING ITS RATED LOAD OPERATING TEMPERATURE, IF THE WK<sup>2</sup> OF THE LOAD, THE LOAD TORQUE DURING ACCELERATION, THE APPLIED VOLTAGE AND THE METHOD OF STARTING ARE THOSE FOR WHICH THE MOTOR WAS DESIGNED.”**
- .12 providing “line” side power connections to Division 15 control system equipment.
- .8 Note that you will be liable for replacing motors due to abuse of the above prior to acceptance of the work. If additional starts are required, it is recommended that none be made until all conditions affecting motor operation have been thoroughly investigated and the apparatus examined for evidence of excessive heating. Note that the number of motor starts should be kept to the absolute minimum since the life of the motor is affected by the number of starts.
- .9 Where applicable, line voltage thermostats that are supplied by Division 15 and turned over to Division 16 to install, shall be provided with required wiring in conduit and connections by Division 16. Coordinate exact requirements with Division 15.

**END OF SECTION 16400**

## **SECTION 16500 – LIGHTING**

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## **SECTION 16500 – LIGHTING**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 Section 16010 applies to and is a part of this Section.
- .2 Section 16050 contains requirements, products and methods of execution that apply to this Section.

#### **1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 The following work which is related to the lighting work is specified in other Sections:
  - .1 finish painting of exposed conduit and equipment.

#### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings for equipment and accessories specified in this Section. Include photometric data for all luminaires. Submit data on lamps, ballasts and accessories for each luminaire.

#### **1.4 WARRANTY**

- .1 Unless otherwise noted, warrant fluorescent and High Intensity Discharge (HID) lamps and associated standard ballasts for a period of 12 months from the date of acceptance of the Work. Warrant incandescent lamps for the period of their rated life from the date of acceptance of the Work. Include costs for personnel, equipment and labour for replacing lamps and ballasts that became defective during the period of the Warranty.

### **PART 2 - PRODUCTS**

#### **2.1 LUMINAIRES**

- .1 Luminaires shall be in accordance with the luminaire schedule sheets found at the end of this Section and shall be CSA approved or have special ESA approval.
- .2 Unless otherwise noted, fluorescent luminaire bodies shall be constructed from minimum 20 gauge cold rolled prime steel and of rigid construction to permit any suspension method without sag. Unless otherwise noted, provide body finishes of corrosion resistant, chemically treated and electrostatically spray-painted baked white enamel. Reflecting surfaces to be white with an average reflectance of not less than 85%.
- .3 Provide neoprene or silicone gasketing, barriers and stops where required to prevent light leaks or water/water vapour penetration.
- .4 Fabricate housings to allow for easy accessibility and replacement of parts.
- .5 Fabricate fixtures with a minimum number of joints. Make unexposed joints by acceptable method such as welding, brazing, screwing or bolting. Soldered joints are unacceptable. Do not use blind metal tapping methods or rivets for fastening parts which must be removed during service, or for fastening electrical components and supports. All cast parts, including die-cast members, shall be of uniform quality, close grained, rigid, true to pattern, free from blow holes, pores, discoloration, hard spots, shrinkage defects, cracks or other imperfections that affect strength and appearance or are indicative of inferior metals or alloys.
- .6 Reflectors and reflecting cones or baffles shall be free of any tooling marks, spinning lines or marks by other assembly techniques. For fluorescent sources, iridescence shall be low. Finishes to be equal to first quality polished, baffled and anodized "Alzak."
- .7 All lamp sockets shall be suitable for the indicated lamps and shall be set so that lamps are positioned in optically correct relation to all luminaire components. All adjustable sockets shall be preset at the factory for lamp specified.

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- .8 Unless otherwise noted, acrylic lens shall be constructed from 100% virgin acrylic and not less than 3.22 mm (0.125") thick. Glass lenses shall be minimum 9.5 mm thick.
- .9 Exterior luminaire poles shall be provided of corrosion resistant finish and construction. All exterior luminaire exposed parts and hardware shall be corrosion resistant. Pole suppliers shall ensure that poles supplied are suitable for the steady wind velocity and gust velocity of the area of installation, and suitable for the total effective projected area of the lighting equipment.
- .10 When requested, submit luminaire samples.
- .11 Dimensions for coves, valances and strips as shown on the drawings are for bidding purposes only. Job measure for exact dimensions of louvres, lenses and strips.
- .12 Confirm exact colours and finishes of luminaires with the Consultant after award of contract but prior to ordering. Obtain information in time to meet installation schedule.
- .13 Unless otherwise noted, luminaires requiring ballasts shall be provided with its own ballast and ballasts shall not be shared.

### 2.2 LAMPS

- .1 Philips Lighting, "ALTO II" Silhouette Series, phosphor coated, reduced mercury energy saving, programmed rapid start, 4'-T-5 lamps with colour temperature of 4100K (for tendering purposes), colour rendering index (CRI) or at least 80, rated average life of a minimum 36,000 hours with programme start ballasts and based on 12 hour cycles) and initial lumens of at least 2950 at 28 w. confirm colour temperature requirements with Consultant prior to ordering. For non-climate controlled areas, lamps shall be high output types suitable for reliable starting and operation at low temperatures and be supplied with proper low temperature operating ballasts. Acceptable lamps shall include OSRAM Sylvania "ECOLOGIC Octron 800" series lamps.
- .2 Compact fluorescent lamps shall have a rated average life of a minimum 10,000 hours, colour temperature of 4100K, minimum colour rendering index of 80 and complete with electromagnetic energy saving ballasts as recommended by the lamp manufacturers.
- .3 High Intensity Discharge (HID) lamps shall be of wattage rating indicated on luminaire schedule. Unless otherwise noted HID lamps shall be coated types. All HID lamps shall be same manufacturer and of same production batch.
- .4 High pressure sodium lamps shall be coated types, with apparent colour temperature of approximately 2100K, minimum lamp life of 24,000 hours and CRI of at least 21. Lamp and ballast combination must be compatible and meet ANSI specifications.
- .5 Incandescent lamps shall be rated for 125 volt power supply and for use on 120 volt (nominal) supply. Lamps shall be suitable for burning in any position. Reflector lamps shall have minimum life of 2000 burning hours lamp life. Unless otherwise noted, conventional filament incandescent lamps shall have minimum life of 1000 burning hours at rated voltage and colour temperature of 2700K.
- .6 Confirm exact colour temperature of lamps with Consultant, prior to ordering. Fluorescent lamp lengths shall be as noted on luminaire schedules.
- .7 Acceptable manufacturers are Phillips Lighting and OSRAM Sylvania Ltd.

### 2.3 FLUORESCENT LUMINAIRE BALLASTS

- .1 Fluorescent luminaire ballasts for T5 fluorescent lamps shall be OSRAM Sylvania programmed rapid start electronic ballasts as follows:
  - .1 CSA approved and ULC listed and labelled;
  - .2 comply with FCC Rules and Regulations, and ANSI Spec C62.41-1980/C62.45-1987;
  - .3 in accordance with ANSI Spec C82.11;

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- .4 Class A sound rating;
  - .5 capable of starting lamps down to 0°C;
  - .6 total harmonic distortion not greater than 10%;
  - .7 minimum power factor of 0.97 and ballast factor of at least 0.88;
  - .8 lamp current crest factor not greater than 1.7;
  - .9 frequency of operation between 20 kHz minimum to 60 kHz maximum, but not between 30kHz. and 42 kHz; lamps shall operate without visible flicker;
  - .10 EMI/RFI filtering;
  - .11 nameplate identifying manufacturer, model number, electrical data and standards of compliance;
  - .12 5 year full replacement parts and labour included warranty.
  - .13 Ballast must integrate with Lighting Control System – Fifth Light DALI Ballast or approved equal.
- .2 Ballasts for compact fluorescent lamps shall be dedicated to size of lamps and designed to operate the lamps with which they are used. Unless otherwise noted, ballasts shall be rapid start and high power factor electronic types. Circuitry shall be provided to sense end of lamp life.
  - .3 Acceptable manufacturers of ballasts are DALI, Osram Sylvania, Advance Transformer Co. (Phillips) and Universal. .

### 2.4 HIGH INTENSITY DISCHARGE BALLASTS

- .1 Advance Transformer Co., CSA approved, high power factor (95%) or better), nominal ballast factor of 1.0, constant wattage design, high intensity discharge ballasts capable of delivering lamp performance with input voltage fluctuation of  $\pm 10\%$ , and reliable lamp starting in ambient temperatures as low as -30°C (-20°F). Each ballast shall be complete with a core of laminated electrical grade steel, Class H (180°C) insulation, and colour coded and insulated copper conductor leads. Ballasts shall be auto regulated and multi-voltage units.
- .2 Metal halide ballasts shall be pulse start types partnered with compatible metal halide lamps.
- .3 Ballasts integral with luminaries shall be core and coil type and shall be encapsulated utilizing Class H polyester compound.
- .4 Remote mounting ballasts shall be encased type with a steel barrier in the enclosure to shield the capacitor from heat generated in the core and coil, spacers and fill to permit mounting in any desired position, and suitable mounting hardware.
- .5 Remote ballasts located outdoors shall be weather-proof with a weather-tight steel case and cover, and integrally moulded neoprene insulated leads with a water-proof plug at the casing entrance.
- .6 Ballast and lamp combination must be compatible.
- .7 Acceptable manufacturers are Advance Transformer Co., Universal/Magnetek and Osram Sylvania.

### 2.5 WALL BOX DIMMERS

- .1 Lutron Electronics Co. “Nova-T” Series, ULC listed and labelled, CSA approved wall box dimmers as follows:
  - .1 of type and size to suit intended lamp loads;
  - .2 air gap accessible without removing faceplate, to meet UL20 and UL1472 short circuit test requirement for snap switches;

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- .3 withstand voltage surges up to 600V and current surges up to 200A as per ANSI/IEEE C62.41;
  - .4 voltage regulated;
  - .5 power failure memory;
  - .6 LC filtering to minimize RFI;
  - .7 linear slide with smooth and continuous square law dimming curve operation;
  - .8 snap on faceplate (seamless multigang at locations with multiple devices);
  - .9 finish to Consultant's direction.
- .2 Acceptable manufacturers are Lutron and Hubbell.
  - .3 Acceptable manufacturers are Intermatic Inc., Paragon Electric and Tork Canada Ltd.

### 2.6 OCCUPANCY SENSORS

- .1 Watt Stopper Inc., (905-608-1260), CSA approved devices to provide automatic control of lighting with the following components:
  - .1 power and slave packs;
  - .2 ultrasonic occupancy sensors;
  - .3 passive infrared sensors;
  - .4 wiring in conduit and mounting hardware.
- .2 Power packs shall be self-contained, 120VAC/24VDC (or of voltage shown on drawings) transformer relay system. Slave packs shall contain isolated relay and be series S120-120 VAC.
- .3 Ultrasonic sensors shall be 24 VDC, solid state, omni directional (360°) ceiling mounted types with user adjustable time control and adjustable sensitivity. Provide No. WT600 or No. WT1000 in washrooms, change rooms, storage rooms and offices, etc.; DT300 series dual technology sensors in classroom spaces and WT2255 series sensors in corridors. Refer to drawings for exact locations.
- .4 Passive infrared sensors shall be 24 VDC, dual element pyroelectric type with user adjustable time delay, adjustable sensitivity, fresnel lenses and LED indicator. Provide No. CX-105, omni-directional (360°) coverage for gymnasium and other large spaces complete with wireguard.
- .5 Override switches shall be flush wall mounting.
- .6 Wiring in conduit, mounting hardware and ancillary devices shall be provided as per manufacturer's requirements.
- .7 System shall be complete with 5 year unlimited parts warranty and 1 year parts and labour warranty.
- .8 Acceptable manufacturers are Watt Stopper, Fifth Light.

### 2.7 EMERGENCY LIGHTING BATTERY UNITS

- .1 Emergi-lite "ESL" Series, CSA approved, 120 VAC/24 VDC emergency lighting battery units. The units shall be complete with batteries, charger, dual lampheads per unit (where shown); cabinet and 1.2 m (4') AC cord and plug set. Units shall also be complete with automatic testing and self-diagnostic circuitry. The system shall be designed to provide emergency lighting levels in accordance with the OBC requirements.

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- .2 The chargers shall be fully automatic, solid-state type that automatically and instantaneously energizes lamp load upon failure of AC supply. Battery protection circuit automatically shuts down lamp load when battery reaches full discharge. Chargers shall fully recharge battery in 12 to 24 hours and shall be current limited and short circuit proof.
- .3 The batteries shall be long life sealed lead, maintenance free and shall have a capacity to supply sufficient output power to the lamp loads and to exit sign emergency loads for a period of time in accordance with the latest requirements of the OBC but which shall be a minimum of 30 minutes. Batteries shall be designed for and guaranteed for at least 10 years of life expectancy.
- .4 The cabinets shall be constructed of No. 18 gauge steel, finished in white enamel. Front cover shall be removable to provide easy and full access to battery and charger connections. Knockouts shall be provided on top for the lampheads. Cabinet shall include protective wireguard.
- .5 Units shall include "PUSH-TO-TEST" switch, AC and high charge pilot lights and AC cordset.
- .6 Integral lampheads shall be 24 volts, 20 watts, quartz halogen, decorative design, high impact plastic, adjustable, dual heads complete with wireguards.
- .7 Unless otherwise noted, remote surface mounted heads shall be type EF40, vandal resistant polycarbonate lens type, single and double adjustable head complete with 24V-20W MR16 lamps.
- .8 Include costs for manufacturer's authorized representative to perform on-site after installation testing and commissioning of the equipment. Such work to be performed during premium after hours time.
- .9 Acceptable manufacturers are Emergi-lite, Lumacell and Beghelli.

### 2.8 DECORATIVE CONCRETE BASES

- .1 Art Forms International Inc., (905-642-3225) model no. NEWAVEA 510R, high/low cast-in-place architectural concrete bases for all pole mounted exterior luminaires. Bases shall be as follows:
  - .1 complete with breakaway construction forms;
  - .2 vertical steel reinforcing rods and horizontal steel reinforcing ties;
  - .3 cast and cured as per Division 3 requirements;
  - .4 coordinated with installation of poles/bollards and conduits;
  - .5 self locking; vandal resistant wrap around aluminium band of finish confirmed with Architect.
- .2 Confirm exact finishes with Architect prior to ordering. Install bases in strict accordance with manufacture's instructions. Coordinate work with general trades work.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF LUMINAIRES

- .1 Provide luminaires as scheduled.
- .2 Thoroughly review ceiling types, finishes and construction details before placing luminaire orders, and ensure that required mounting assemblies, frames, rings and similar features are included. Confirm colours and finishes with the Consultant prior to ordering.
- .3 Include for assembly and mounting of luminaires and lamps, complete with wiring, connections, fittings, hangers, aligners, box covers and accessories required for a complete, safe and fully operational assembly. Luminaires shall be supported directly by the ceiling slab structure and not to ceiling hangers, ductwork, piping, cable trays, etc.
- .4 Do not tighten wing nuts, bolts, or screws that allow fixture adjustment for recessed adjustable fixtures.

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- .5 Install spread lenses only where called out on the Luminaire Schedules and Specifications.
- .6 Use cloth gloves when handling reflector cones, louvres, halogen lamps, glass, sconces and all exposed surfaces of fixtures.
- .7 Install fixtures in lay in ceiling in centre of tile unless dimensioned otherwise on Reflected Ceiling Plans.
- .8 Provide spacers for fixtures mounted on low density ceiling material.
- .9 Provide plaster frames for recessed fixtures in plaster or gypboard ceilings.
- .10 Install fixtures in and on acoustical tile ceilings in alignment with tile joints.
- .11 Prepare fixtures, trim and poles and standards required to be painted.
- .12 Where outlet boxes locations as shown on drawings, they are diagrammatic only. Position outlet boxes to coincide with suspension hangers and knockouts.
- .13 Wiring between fluorescent lampholders and associated operating and starting equipment shall be of similar or heavier gauge than the leads furnished with the approved types of ballasts with equal or better insulating and heat-resistant characteristics.
- .14 Wiring shall be protected with tape or tubing at all points where abrasion may occur. Wiring shall be concealed within the fixture construction except where design or mounting dictates otherwise.
- .15 Minimize splices. Make splices with approved mechanical insulated steel spring type connectors, suitable for temperature and voltage conditions to which splices are to be subjected.
- .16 Carefully coordinate the luminaire installation with the work of other trades to ensure that the necessary recessing depths and mounting spaces are provided.
- .17 Install luminaires in accordance with applicable architectural drawing reflected ceiling plans and/or wall elevations and/or field instructions issued by Consultant. Confirm luminaire locations prior to roughing-in. In equipment rooms, shafts and similar secondary areas, install luminaires after the mechanical and other major work is roughed in and adjust luminaire locations as required.
- .18 If requested, demonstrate the operation of special applications of luminaires such as building floodlights and other decorative luminaires, and adjust their locations within a reasonable distance to obtain the effects desired.
- .19 Align and position all adjustable luminaires, and ensure that luminaires with adjustable lamp holders are properly positioned to correspond to the lamps specified.
- .20 Comply with the requirements of OESC regarding support of luminaires in suspended ceilings.
- .21 Note: Fluorescent luminaires in suspended ceilings must be independently suspended from the ceiling slab. For each luminaire, provide minimum two (2) cable supports secured to ceiling slab and to luminaire.
- .22 Contractor to notify immediately if fixture placement is in conflict with a structural beam, mechanical duct, plumbing pipe, a space above ceiling is not sufficient, or any other reason that a fixture can not be located where it is dimensioned or shown on the construction documents. Contractor is to move fixture, if necessary, where Consultant decides.
- .23 All lamps shall be new and intact when the project is complete and ready for acceptance.
- .24 Include a full lamp listing in the Operating and Maintenance Instruction Manuals.

## SECTION 16500 – LIGHTING

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- .25 Secure poles for pole mounted, exterior type luminaires to concrete bases as detailed. Provide required work including excavation/backfilling/concrete work to provide bases as shown. Provide anchor bolt covers and anchor bolt templates for proper positioning of anchor bolts in the concrete. Refer to the concrete base detail found on drawings. This detail is for general requirements only. Additional details may be confirmed with the Architect. Include costs for a Professional Engineers of Ontario licensed Structural Engineer to review and endorse base work. Grade levels may be different in various areas. Coordinate work.
- .26 Secure grade mounted building floodlighting luminaires to concrete pads set flush with finished grade level.
- .27 Provide remote ballasts for luminaires as scheduled. Secure in place where shown, and connect complete.
- .28 Provide safety cables for HID fixtures with integral ballasts. Attach cables to fixture and building structure. Safety cable to be designed and secured so as to withstand the sudden weight of the fixture.
- .29 Connect designated circuits to Division 15 building management system. Provide required contactors, wiring in conduit, connections, etc.

### 3.2 INSTALLATION OF WALL BOX DIMMERS

- .1 Provide flush wall box dimmers where shown and connect to control lighting as indicated and as required. Confirm exact locations prior to roughing-in. Equip each dimmer with a faceplate. Confirm faceplate colour prior to ordering.
- .2 When installation is complete, check and test operation of each dimmer and adjust as required.
- .3 Ensure that each dimmer is properly sized and of type to suit the connected load.

### 3.3 INSTALLATION OF EMERGENCY LIGHTING

- .1 Provide emergency lighting battery units as scheduled and wall mount each on a shelf where shown. Plug each unit into an adjacent receptacle. Confirm exact mounting heights and locations prior to roughing-in receptacles. Extend wiring in conduit and connections to remote lampheads and exit lights, back to central battery unit serving area and connect complete.
- .2 Note that drawings identify location for battery units and generally identify circuiting of remote heads. In absence of direction of circuiting, provide wiring in conduit to feed the remote heads and exit lights from nearest battery unit with sufficient capacity in the area, in accordance with application requirements, manufacturer's requirements and applicable codes. Multiple battery units may be required to accommodate the connection of remote heads in some areas. Provide sufficient battery units to accommodate connected lamp loads and system design time of operation. Note that where more than one battery unit is installed in same immediate location, only one unit is required to be provided with integral lampheads.
- .3 Provide remote mounting lampheads as specified and as required for system performance in compliance with OBC. Install lampheads in locations as shown on the drawings. Connect complete to the battery units. Be responsible for revisions to system, including relocations, aiming and additional remote heads as determined by testing results. Generally, wiring shall be in accordance with manufacturer's requirements and be minimum No. 10 AWG, but must be increased to suit voltage drop requirements reviewed with system manufacturer.
- .4 Provide wiring in conduit and install devices in accordance to manufacturer's instructions.

- .5 When installation of emergency lighting equipment is complete, and in conjunction with the manufacturer's representative, commission and test the entire system, adjust as required, and certify in writing to the Consultant that the system is complete, have been tested, adjusted, and are in proper operating condition. Testing shall be performed during non-daylight hours. Also, be responsible for engaging the emergency lighting manufacturer to perform an illumination level test in the presence of the Consultant, throughout all areas of the building. Manufacturer shall be responsible for properly aiming remote light heads, recording light level readings on a record set of floor plans, calculating light level readings, and issuing to the Consultant, a signed letter documenting light level readings and stating that the emergency lighting levels meet the requirements of the Ontario Building Code. Notify Owner and Consultant at least 10 days prior to proposed testing date and schedule testing at time and date acceptable to Owner and Consultant.

### 3.4 INSTALLATION OF OCCUPANCY SENSORS

- .1 Provide occupancy sensors and associated devices to control lighting in areas as shown on drawings. Unless otherwise shown, sensors are required in rooms that are not occupied most of the time, i.e. washrooms, electrical/mechanical rooms, store rooms, etc.
- .2 Exact type of occupancy sensors and type of lenses shall be verified by the manufacturer/supplier to ensure proper coverage in sensed areas only.
- .3 It shall be the Contractor's responsibility to provide, locate and aim appropriate sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have 90-100% coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown and/or noted are illustrations only and should only be used as guidelines. The Contractor shall provide additional sensors at his cost if required to properly and completely cover the respective room.
- .4 It is the Contractor's responsibility prior to Bidding to verify with the manufacturer's factory authorized representative, the exact type of sensor to be used in each area, placement of sensors and installation criteria, to best meet the requirements of the end user. The manufacturer's representative should be consulted for more non-typical installation types.
- .5 Proper judgement must be exercised in executing the installation so as to ensure that the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The Contractor shall also provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.
- .6 Install devices in accordance with manufacturer's instructions. Provide wiring in conduit. Provide required power connections and interconnection to luminaires and power panels. Provide manual switches to override control system in each area/room as shown.
- .7 Confirm finishes of sensors with Consultant prior to ordering.
- .8 Sensors shall not protrude more than 32 mm (1-1/4") from ceiling/wall.
- .9 Confirm mounting heights with Architect and manufacturer prior to roughing-in and installation.
- .10 Adjust sensitivity and time delays to best suit Owner's furniture layout drawings. Allow for minor adjustments of locations (1 m [3']) of sensors.
- .11 After installation is complete, provide for manufacturer's authorized representative to inspect, test and verify system performance and installation.
- .12 After completion of project and within 30 days after Owner has taken occupancy and furnishings are in place, provide for manufacturer's authorized representative to revisit the site to test and make final adjustments.



**END OF SECTION 16500**

## **SECTION 16700 – COMMUNICATIONS**

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## SECTION 16700 – COMMUNICATIONS

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### PART 1 - GENERAL

#### 1.1 REFERENCES

- .1 Section 16010 applies to and is a part of this Section.
- .2 Section 16050 contains requirements, products and methods of execution that apply to this Section.

#### 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 The following work which is related to the lighting work is specified in other Sections:
  - .1 finish painting of exposed conduit and equipment.

#### 1.3 SHOP DRAWINGS

- .1 Submit shop drawings for equipment and accessories specified in this Section. Include photometric data for all luminaires. Submit data on lamps, ballasts and accessories for each luminaire.

#### 1.4 WARRANTY

- .1 Unless otherwise noted, warrant fluorescent and High Intensity Discharge (HID) lamps and associated standard ballasts for a period of 12 months from the date of acceptance of the Work. Warrant incandescent lamps for the period of their rated life from the date of acceptance of the Work. Include costs for personnel, equipment and labour for replacing lamps and ballasts that became defective during the period of the Warranty.

### PART 2 - PRODUCTS

#### 2.1 FIRE ALARM SYSTEM

- .1 GE Security (Edwards System Technology), EST3 series, CSA approved and ULC listed and labelled (CAN/ULC - S527) components for a fully electrically supervised, addressable, microprocessor based, single stage, zoned, modular, fire alarm system that is in compliance with all applicable requirements of local governing authorities. The system shall meet specific application requirements and local code requirements.
- .2 The system shall include the following components:
  - .1 main control panel with LCD and integral LED annunciator and system software;
  - .2 remote annunciators;
  - .3 addressable alarm initiating devices;
  - .4 alarm signalling devices;
  - .5 control connections to building systems and equipment;
  - .6 batteries and battery chargers, end-of-line devices and all required ancillary devices;
  - .7 wiring in conduit.
- .3 All system components shall be listed as the products of a single manufacturer under the appropriate category by the Underwriter's Laboratories and shall bear the ULC label. All system components and work in conjunction with the system installation must be in accordance with the latest applicable requirements of the Local Electrical Code, ULC, OBC, applicable municipal requirements for building permit approval and local governing authorities. The system software shall be of open protocol. All system programming shall be performed by manufacturer's technician. Include for additional two (2) on-site programming periods after successful system testing and verification of the system, for any revisions required by Owner. Refer to Part 3 of this Section for additional programming requirements.

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- .4 The exact type of device to be used in each area of installation must be as recommended by system manufacturer to suit specific applications and to be approved for such use as per ULC standards. Devices in non climatic controlled areas must be weatherproof, corrosion resistant and ULC listed for use in below freezing temperature. The system manufacturer shall be responsible for ensuring compliance with this.
- .5 Control Panel:
  - .1 The control panel shall be a surface wall mounting, dead front, modular cabinet assembly with trim, a hinged door with full glazing, a lock, and keys. It shall be complete with an LCD and an integral LED annunciator with alarm and trouble LED's for each zone scheduled and shall be similar to the remote annunciator. All controls, indicators and operating instructions shall be clearly visible through a viewing window. The door shall provide access to all operator controls, but shall not expose live electrical connections. All electrical connections shall be front access through a removable inner protective cover. Control panel shall be provided with a blank coverplate over the paging microphone.
  - .2 The fire alarm control panel shall allow for loading or editing of special instructions and operating sequences as required. The system shall be capable of on-site programming to accommodate expansion, and changes required by local codes. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
  - .3 The ability to selectively program input/output control functions based on ANDing, ORing, NOTing, Timing and Special Coded Operations is also to be incorporated in the resident software programming of the system.
  - .4 The system shall have the ability to manually disable and enable any device/circuit individually, via software, for maintenance or testing purposes.
  - .5 It shall be possible to program selected, or all smoke sensors for alarm verification operation.
  - .6 It shall be possible to program an adjustable time delay circuit for each water flow initiating circuit to prevent false alarms that may be caused by erroneous pressure surges in the sprinkler system.
  - .7 All on-site programming changes to the fire alarm system shall be password protected. DURING THE CONSTRUCTION STAGE, ALL PROGRAM AND CUSTOM LABEL CHANGES SHALL BE APPROVED IN WRITING BY THE CONSULTANT.
  - .8 Include costs for additional two (2) on-site system reprogramming sessions for any after verification/commissioning revisions required by the Consultant.
  - .9 Wiring to any remote annunciator shall be supervised for open and ground conditions
  - .10 All Control Panels and Remote Annunciator Cabinets are to be properly grounded to building ground. Conduit ground will not be acceptable. The green coloured grounding loop shall be a minimum #10 AWG. insulated copper run in conduit. The ground loop shall be connected to main building ground system source. Ground wire must not be run in the same conduit as the Fire Alarm and Communication wiring.
  - .11 The fire alarm control panel construction shall be modular in design with solid state microprocessor based electronics. A Liquid Crystal Display (LCD) shall indicate alarms, supervisory service conditions and all troubles. The panel shall include but not be limited to the following:
    - .1 8 lines by 21 character LCD display;
    - .2 2500 Addressable Point Capacity;
    - .3 15 Hardwired Circuit Capacity;

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- .4 Local Energy, Shunt Master Box, or Reverse Polarity Remote Station Connection;
  - .5 Form C Trouble Contact;
  - .6 Earth Ground Supervision Circuit;
  - .7 Front Panel Ground Fault Isolation Control;
  - .8 8 Amp intelligent power supply;
  - .9 Automatic Battery Charger;
  - .10 Standby Batteries;
  - .11 Resident non-volatile programmable operating system memory for all operating requirements;
  - .12 Five Programmable Multi-Function keys with status LED's;
  - .13 Red Fire Alarm LED and Acknowledge Button;
  - .14 Red Priority 2 LED;
  - .15 Yellow Supervisory Service LED and Acknowledge Button;
  - .16 Yellow Trouble LED and Acknowledge Button;
  - .17 Green Power on LED;
  - .18 Alarm/Signal Silence LED and Button;
  - .19 System Reset Button;
  - .20 Operator Interface Keypad for Manual Control and System Information Access;
  - .21 Addressable Interface Control Modules (as required);
  - .22 Serial DACT Module;
  - .23 Supervised Annunciator Circuit.
- .12 Control Panel shall be capable of chronologically logging and storing minimum 300 events in an alarm log and minimum 300 events in a trouble log. The historical logs shall be stored in the CPU's memory and shall be protected by a lithium battery that is supervised for a low battery condition. Each recorded event shall include the time and date of that event's occurrence. The alarm log file must be separate from the trouble log file. It shall be possible for the user to generate a report of both logs upon request.
- .13 All hardwired initiation and control circuits shall be individually configurable, on-site, in any combination, to provide either initiating circuit, signal circuit, or auxiliary control circuit operation. These circuits must come with a Ground Fault Isolation Relay, allowing them to be isolated via the front panel keyboard without having to remove any field wiring.
- .14 Initiation circuits/addresses shall be individually configurable on-site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching monitoring circuit or a alarm verification circuit.
- .15 Notification appliance circuits (NAC), (speaker/strobe circuits), shall be independently supervised and fused such that a fault on one circuit shall not affect the operation of any of the other circuits. All NACs shall be configured as follows:
- .1 Class "B" wiring, current limited;
  - .2 rated at two amps of continuous power;

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- .3 capable of powering polarized 24 VDC audible/visual signalling appliances;
- .4 supply two NAC s per floor.
- .16 Auxiliary control circuits shall be as follows:
  - .1 central Station alarm output;
  - .2 central station trouble output;
  - .3 SPDT Form C relays fused at 2 Amp @ 24 VDC.
- .17 System Expansion Modules connected by ribbon cables shall be supervised for module placement. Should a module become disconnected the system trouble indicator must illuminate and audible trouble signal must sound.
- .18 The Fire Alarm Control Panel shall be capable of supporting 2 RS-232-C I/O ports. CPU data output to the I/O ports shall be in a parallel ASCII format at field adjustable baud rates of 220, 300, 1200, 2400 and 4800.
- .19 The system shall be modular in design to allow future expansion with a minimum of hardware additions and system interruptions.
- .20 Isolators shall be provided between building dividing walls.
- .21 The control panel shall have minimum 25% spare supervisory and annunciating capacity (minimum one (1) spare speaker circuit and two (2) spare zone circuits) and provide the following functions:
  - .1 fire alarm control;
  - .2 fire alarm annunciation;
  - .3 supervisory and trouble annunciation.
- .22 The fire alarm control panel shall come complete with a serial digital alarm communicating transmitter (SDACT) which shall monitor the status of the host fire alarm control panel and its connections to the central station monitoring receiver. When status changes require information to be reported, the SDACT can provide a per point message, (i.e. every addressable device within the system on an individual basis), that can assist the central station in more accurately implementing the required response. Typical information reports would include alarms, troubles, and supervisory conditions with specific point identification. The SDACT module shall mount internally to and communicate directly with the fire alarm control panel. The SDACT module shall internally to and communicate directly with the fire alarm control panel.
- .23 Amplifiers shall supply required signals for tones to audible devices and shall be sized to accommodate the audible device loads (assume 1watt tapping for determination of amplifier capacity) plus an additional 20% spare capacity per audible device zone to accommodate future additions. Amplifiers shall be continuously supervised for proper operation.
- .6 Walktest with History Logging:
  - .1 Provide all necessary software and programming to provide one-man system testing, as follows:
    - .1 initiating the walk-test mode shall automatically disconnect all auxiliary control circuit relays, and create a system trouble indication on the control panel;

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- .2 the alarm activation of any initiating device shall cause the audible signals to pulse one round of code over the alarm signal circuits identifying the zone of alarm to the testing technician without having to return to the fire alarm control panel. The alarm initiating zone shall be silently logged as being tested in the historical data file. The panel shall automatically reset itself after logging of the alarm;
  - .3 any momentary opening of an initiating or indicating appliance circuit shall cause the audible signals to sound for 4 seconds to indicate the trouble condition. The trouble condition shall be silently logged as a trouble condition in the historical data file. The panel shall automatically reset itself after logging of the trouble condition;
  - .4 should the walktest feature be on for an inappropriate, (programmable), amount of time, it shall revert to the normal mode automatically;
  - .5 actuation of the walktest program shall not require any special tools or programming knowledge by the owner or operator.
- .7 Power Supply:
- .1 The control panel shall accept 120 volts, 60 Hz as the primary source of power for the system. The power supply shall provide 24 volts regulated output, current limited distributed system power. Primary power failure or power loss (less than 102 volts) shall activate the common trouble sequence.
  - .2 The emergency power supply shall be a d.c. battery power source to supply sufficient standby capacity to operate the entire system upon loss of normal power. The emergency power supply shall consist of a battery charger and batteries to provide an automatic un-interruptible transfer of power to the loads during primary power failure or loss. During normal operating conditions a fault in the battery charging circuit, a short or open in the battery leads shall activate the common trouble sequence. Continuous supervision of the wiring for the initiating and alarm circuits shall be maintained during power failure.
  - .3 The batteries shall be sized in accordance with the latest requirements of the OBC, and shall be maintenance free, dual-sealed gelled cell type equipped with charging circuits capable of recharging fully depleted batteries to within 70% of their maximum capacity within 12 hours. The ampere-hour capacity shall be adequate to operate the system under supervisory conditions for a minimum of 24 hours with AC power disconnected, and to provide emergency power under full load for OBC required length of time but which must be at least 30 minutes at the end of this period. Confirm exact requirements with local fire authority. These requirements shall be tested and demonstrated. Refer to Part 3 of this Section. The system shall automatically transfer to standby batteries upon power failure. All battery charging and recharging operations shall be automatic.
  - .4 The power supply and control equipment shall be complete with transient voltage surge suppressor unit as recommended and provided by the fire alarm system manufacturer.
- .8 Addressable Device Network:
- .1 The system must provide communication with addressable initiating devices. All of these devices will be annunciated on the control panel's main LCD/LED display. Annunciation shall include the following conditions for each point:
    - .1 zone/device location;
    - .2 type of device;
    - .3 detector status (normal/alarm/trouble);
    - .4 device missing/failed;
  - .2 A minimum of 100 addressable devices may be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices are unacceptable.

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- .3 The communication format must be a completely digital poll/response protocol. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
- .4 Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
- .5 The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions. Systems which cannot support 100% of their point capacity in alarm simultaneously cannot assure appropriate system response and are not acceptable.
- .6 The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Class A communications circuit. Each addressable loop shall be wired Class A, and run in a Class A conduit system with the return run separated by a minimum of 24" from the primary run. The appropriate quantity of isolator modules shall be installed so that a wiring fault (short, open or ground) within one floor area shall not prevent the normal operation of other addressable devices on other floor areas.
- .9 Remote Trouble Indicator:
  - .1 Provide a remote trouble indicator in the Main Server LAN room as shown on the floor plans. The unit shall provide a yellow LED which shall illuminate and a low frequency piezo which shall sound upon a trouble condition being received at the main control panel. The unit will be reset when the controlling contact is reset.
- .10 Remote Annunciators:
  - .1 The remote active annunciator shall be flush wall mounted with baked enamel finish to Architect's direction, and be complete with following features:
    - .1 alarm LED for each fire zone;
    - .2 supervisory LED for each sprinkler and standpipe zone;
    - .3 each zone shown separately and identified by different colour;
    - .4 all alarm and supervisory zones identified with white lamacoid plate with black lettering;
    - .5 LCD display indicating address of device in alarm and details of system operating conditions;
    - .6 all LED's shall be high intensity types and be supervised;
    - .7 trouble buzzer.
  - .2 Multi coloured passive graphic display as follows:
    - .1 electronically stored floor and zone outline, printed on dimensionally stabilized clear film with 3 mm (1/8") thick clear acrylic shield with UV protection;
    - .2 floor outline and zone area designation depicted by a black border with each zone area represented by a separate colour; egress corridors illustrated with black dotted design with zone colour shown behind the pattern; colours must be confirmed with and approved by the Consultant;
    - .3 all exit doors, fire hose cabinets, Siamese connections, elevators, sprinkler pump, gas shut off valves, etc. shall be indicated;
    - .4 "YOU ARE HERE" notation shall be in red;



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- .5 a minimum of six (6) colours shall be utilized in display;
  - .6 anodized aluminum frame (minimum 600 mm x 1 m [2' x 3']) to match remote annunciator with tamper resistant mounting hardware;
  - .7 approved by local fire authority, where required.
- .11 Zone Addressable Modules (ZAM):
- .1 Zone Addressable Modules (ZAM) shall be used for the monitoring of water flow, valve tamper, non-addressable detectors, and for control of fans or dampers that require shutdown or manual control in an alarm condition.
  - .2 Monitor ZAM's shall monitor any N/O contact device and be capable of powering 2-wire smoke detectors. The ZAM will communicate the zone's status (normal, alarm, trouble) to the transponder. The ZAM's zone address shall be set at the time of installation via a dip switch package. Where multiple ZAMs are required within a room, (for example a sprinkler room), cabinet mount the ZAMs in a locked box, keyed to match the fire alarm control panel. Neatly arrange the ZAMS for easy contractor connection and label each ZAM with a lamacoid plate providing the zone, device address and custom label.
  - .3 Control ZAM's shall be able to provide supervised or non-supervised control of any control function. The ZAM will communicate the zone's status (normal, trouble) to the transponder. Each control ZAM shall provide a double pole double throw relay for switching loads of up to 120 VAC. Each common leg of the relay shall be equipped with a replaceable 2 AMP fuse. The ZAM's zone address shall be set at the time of installation via a dip switch package.
- .12 Addressable Pull Stations:
- .1 Pull stations shall be addressable, single action, non-coded, single stage, semi-flush mounted type. Pull stations shall be break-glass rod, key locked and have one set of sealed N/O contacts. Contacts shall close when the handle is pulled down, activating a fire alarm condition. Additional contacts shall be provided for interconnection to electromagnetic locks and elevators, where applicable;
  - .2 Addressable pull station electronics shall be mounted to the back plate of the station. The station's address will be set at the time of installation via a dip switch package.
  - .3 Pull stations shall be complete with ULC listed Safety Technology International Inc. (STI) clear, UV stable polycarbonate, tamperproof shields complete with integral horn.
  - .4 Provide wireguards over stations identified as "WG."
- .13 Addressable Sensor Bases:
- .1 The electronics that communicate the sensors status to the control panel shall be contained in the base. Upon removal of the head, a trouble signal will be transmitted to the control panel. The detector's address will be set at the time of installation.
  - .2 Where shown on the drawings, provide an additional alarm relay (Form C, SPDT), normally open contact, for auxiliary functions.
- .14 Addressable Thermal Detectors:
- .1 Surface ceiling mounted low silhouette design, twist-lock mounting automatic thermal detectors as follows:
    - .1 combination 57°C (135°F) fixed temperature and 9°C (15°F) rate-of-rise type;
    - .2 57°C (135°F) fixed temperature type;
  - .2 Each detector shall be complete with a base plate for mounting to a standard 100 mm (4") outlet box and cast guards for detectors.

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- .15 Addressable Ceiling Mounted Products of Combustion Detectors:
  - .1 Photoelectric type products of combustion detectors, each complete with:
    - .1 low profile design;
    - .2 factory set adjustable sensitivity;
    - .3 an integral L.E.D. alarm lamp;
    - .4 a base plate with wiring terminals, for mounting to a standard 4" (100 mm) outlet box;
    - .5 magnetically operated functional test feature;
    - .6 locking feature to prevent unauthorized removal of unit head from base.
  - .2 Smoke detectors tied to hold open devices shall be complete with required auxiliary set of contacts. Coordinate work with supplier of hold open devices.
  - .3 Automatic smoke detectors shall be equipped with a dust-bag, to be removed at the time of verification to prevent dust and dirt entering the smoke chamber during construction.
- .16 Addressable Duct Mounting Products of Combustion Detectors:
  - .1 Duct housing, complete with:
    - .1 photoelectric detector;
    - .2 duct air sampling tube of suitable required length;
    - .3 remote alarm indicator assembly with LED type lamp and single gang stainless steel faceplate;
  - .2 Provide weatherproof housing type for installations within air intake ductwork.
- .17 Flame Detector:
  - .1 Provide ULC listed flame detector in generator enclosure.
- .18 Audible/Visual Devices:
  - .1 Devices shall be ULC listed and labelled devices. Devices shall include speakers, strobes and combination speaker/strobe units. Devices shall mount on recessed in- wall boxes.
  - .2 For finished areas "Genesis G4" series, speakers and speaker/strobe combination units consisting of cone speaker and synchronized strobe; sound output to 90 dbA @ 3 m (10') tapped @ 2 watts; "FIRE" lens marking; illumination of at least 75 cd @ 15 m (50'); suitable for mounting on flush back boxes; red plastic housing; 25/70 volt operation with 1/4, 1/2 or 2 watt taps.
  - .3 For mechanical rooms, "Integrity 757" series re-entrant type speaker/strobe units consisting of sealed high compression driver with DC blocking capacitor, 2W to 15W taps and 93 dBA @ 3 m (10') at 2W tap; integral synchronized strobe shall be complete with Lexan lens, "FIRE" markings and candela output intensity as approved by local fire authority (range from 15 cd to 12 cd).
  - .4 In finished areas, speaker/strobes shall mount to a 4" square deep (2-1/8") back box. Where speaker/strobes are to be surface mounted, provide a red finished surface back box with no knockouts.
  - .5 Devices mounted exterior and in non-climate controlled areas shall be complete with "weatherproof" box.

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- .19 Wiring:
  - .1 Wire and cable shall be CSA approved and ULC listed for fire alarm circuits, colour coded insulated solid copper conductors, of type as per OESC and local fire authority requirements. All wiring and cable shall be sized and installed in accordance with the system manufacturer's instructions.
- .20 End-of-Line Resistors:
  - .1 End-of-line resistors for standard alarm and signalling circuits, sized to ensure the correct supervisory current flows in each circuit.
  - .2 End-of-line resistors shall be mounted on a stainless steel plate for mounting on a standard single gang box and bear the ULC label.
- .21 Isolators:
  - .1 Isolators shall be provided in accordance with code requirements and installed as per system manufacturer's requirements to isolate/monitor zones, loops, group of devices within the building and between buildings.
- .22 Acceptable Manufacturers:
  - .1 Acceptable manufacturers of fire alarm systems components are GE-Edwards, SimplexGrinnell (4100U) and Notifier (from Vipond).

### 2.2 SECURITY SYSTEM

- .1 DSC Security 'Maxsys' PC4020, CSA approved, ULC listed and labelled, completely electrically supervised, solid state multiplexed microprocessor based electronic security system components consisting of the following:
  - .1 control unit with minimum microprocessor chip L32E38 requirement;
  - .2 z6341 CiTeCII TCP/IP module;
  - .3 complete assembly (control panel and CiTec module) shall comply with ULC 561;
  - .4 required input/output nodes;
  - .5 magnetic door switches;
  - .6 motion detectors;
  - .7 glass break detectors;
  - .8 remote program keypad;
  - .9 remote alarm horns;
  - .10 rechargeable battery backup and battery charger;
  - .11 wiring in conduit and ancillary devices;
  - .12 multi-colour passive display;
  - .13 high speed modem (DSC DPLS Contact ID modem).
- .2 The system shall have zone expander capacity for the number of zones as required for the connected devices and the required monitoring and control points of additional building systems including, but not limited to, the following:
  - .1 each detector;
  - .2 fire alarm system alarm and trouble condition (separately);

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- .3 main A/C power failure;
  - .4 security system low battery;
  - .5 four connections to lighting circuits as designated;
  - .6 sump pit high water level sensor;
  - .7 sump pit chemical feeder sensor;
  - .8 building management system control panel.
- .3 Control panel to be complete with zones as scheduled on drawings plus additional spare 8-zone expansion module for future expansion.
- .4 Initiation of the door alarm contacts or a detector shall cause the alarm horn to operate at the main control unit and shall indicate the zone of alarm on the control unit and shall be capable of sending a signal to a remote Central Monitoring Station and shall activate alarm horns in building. The system shall log all functions initiated through the applied system.
- .5 Control Unit:
- .1 The control unit shall be able to receive unique signals and interpret the coded signal to determine the response that shall occur. The following outputs shall be possible:
    - .1 signal a remote central station;
    - .2 sound a local alarm;
    - .3 signal the police or fire department;
    - .4 signal low temperature and loss of power;
    - .5 control of lighting;
    - .6 a combination of the above.
  - .2 The control shall be equipped with a multi-event memory containing the date and time of each event and this information shall be able to be printed on a line printer or displayed on the remote keypad LCD display.
  - .3 The systems functions shall be controlled by the remote keypad, designed for simplicity and ease of operation. The remote keypad shall be the primary means of interface between the system and the operator. It shall be possible to acknowledge status changes and control the system from the remote keypad.
  - .4 The control shall provide a multi-character LCD display in user selective English language to identify the various zone descriptions, changes of state, etc. It shall display, upon request, points in bypass, alarm, etc.
  - .5 The system shall be capable of being pre-programmed for time schedules. After a holiday schedule is executed, it shall automatically be cancelled, thus assuring that a holiday Monday is not repeated the following Monday without manual programming.
  - .6 The control shall be capable of operating a printer with a minimum print speed of 80 CPS.
  - .7 The control shall have the provision of a selectable duress (via integral auto dialler or other device) signal to a remote ULC Listed Central Monitoring Station. A CA38A alarm jack shall be provided for this interconnection.
  - .8 Provide internal DSC high speed modem, fully connected.
- .6 Remote Keypads:

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- .1 Remote keypads shall be complete with programming pushbuttons, LCD display and Lexan hinged cover box with lock/key set. Provide four (4) keys.
- .7 Motion Detectors:
  - .1 Sentrol model 6155 "Sharpshooter" passive infrared detector with wide angle lens for room area coverage and long narrow range lens for corridors.
  - .2 Sentrol model 5885 "Shatter Pro Plus" glass break detector for ground floor rooms with windows or upper level rooms accessible via lower roof structure.
  - .3 Detectors shall be centrally powered by control panel power supply. Exact type of lenses provided shall be determined to best meet requirements of the application.
- .8 Audible Alarms:
  - .1 Flush wall mounting in single gang boxes to provide minimum 85 dB at 1 m (3') alarm of sound distinctly different from fire alarm audible devices and program bells. Units shall be complete with enamel painted grille cover finished to Architect's direction.
- .9 Door Contacts:
  - .1 Sentrol 1078W, 1" (25 mm) flush mounting contacts for perimeter doors.
  - .2 Sentrol 2204A contacts for overhead type doors and mounted at top of door.
- .10 Battery Backup System:
  - .1 Control panel batteries shall be 12V-7A rechargeable batteries. Batteries shall be provided with the device power supply units to provide continuous 24 hours of operation and supervision of the detectors and sensors upon loss of normal power supply.
- .11 Graphic Display:
  - .1 Multicolour passive graphic display consisting of outline of building showing each floor, stairs, location of each detector, remote mounted modules/relays, zones, etc., as required by School Board. Display shall be minimum 11" x 17" mounted under frame acrylic sheet. Nomenclature (room names and numbers) must be of final wording approval in writing by consultant and owner.
  - .2 Provide an electronic copy of the graphic display, in PDF format, to the School Board.
- .12 Wiring:
  - .1 Wiring shall be FT-6 rated, Teflon coated, copper conductors of minimum No. 22 AWG.
- .13 Miscellaneous:
  - .1 Include for minimum one (1) year all inclusive parts and labour warranty;
  - .2 Include for minimum two (2) hours of operating and maintenance instructions to Owner's designated personnel.
- .14 System Testing and Verification:
  - .1 Manufacturer's authorized technician shall provide system testing, inspection and verification work.
  - .2 Refer to Part 3 of this Section for requirements including a cash allowance to cover third party testing Work.
- .15 Acceptable Suppliers/Installers:
  - .1 Detson Security.

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- .2 KM Enterprise Solutions.
- .3 Pure Energy.
- .4 GE Security;
- .5 AC Technical.

### 2.3 INTERCOM SYSTEM

- .1 The system's primary function is to provide two way audio communication between remote door stations and the master station and release the electric strike on the main entry door from the master station.
- .2 The system components include:
  - .1 master station console;
  - .2 weather resistant door station;
  - .3 power supplies, mounting hardware and ancillary devices;
  - .4 system wiring as per manufacturer's requirements, run in conduit.
- .3 Master Station (Aiphone LEF-3L series): wall mounted in General Office, master station to provide two way communication with door station and provide door release to electric strike at main entry door. Unit shall be complete with the following features:
  - .1 Individual station call and door release buttons;
  - .2 Two talk channels;
  - .3 Hands free, "push to talk" pushbutton and handset;
  - .4 And other standard features inherent with the system.
- .4 Door Station (Aiphone #LE-SS): Hands free audio door stations complete with following features and accessories:
  - .1 stainless steel, vandal resistant, weather resistant;
  - .2 "push to talk" button and speaker to provide two way communication between door station and master station;
  - .3 mounted in flush wall boxes to be provided at secured door locations;
  - .4 Power supplies and homerun system wiring to be provided to system manufacturer's requirements.
  - .5 Acceptable manufactures include, Aiphone, Ring Master, Stentofon and TOA.
- .5 Substation (Aiphone) wall mounted. Refer to plan for phone location. To provide two way communication with door release to electric strike of main entry.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF FIRE ALARM SYSTEM

- .1 Provide a fire alarm system for the building as shown, specified and as required to conform to local fire authority requirements.

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- .2 Include costs for and arrange for the system manufacturer's authorized representative to perform all work within central control equipment and transponders, final equipment connections, and all system programming. Include for the additional future software changes by the manufacturer's authorized representative, to system after total completion of work and verification/commissioning of system.
- .3 The sequence of operation shall be custom programmable with provisions to make revisions easily. The following sequence of operation shall be considered for tendering purposes. The exact sequence must be approved by local fire authority and Consultant prior to start of work. Refer to drawing schedule of operations. Actuation of any alarm initiating device shall cause the following:
  - .1 all audible devices to sound continuously;
  - .2 all visual devices to activate;
  - .3 the zone and address of the device in alarm condition to be indicated at the control panel annunciator and remote annunciator;
  - .4 activation of circuitry to transmit an alarm signal to the Fire Department or to an outside private protection company via the telephone system;
  - .5 designated air handling equipment to start-up or shut-down by means of control wiring from the control panel to equipment starters (as applicable);
  - .6 release all door holders;
- .4 Provide control panel in location as shown on the drawings. Mount all equipment and connect complete in accordance to the manufacturer's instructions and requirements. Arrange for manufacturer's authorized representative to program system with required sequence of operation. Confirm exact sequence with Consultant prior to programming.
- .5 Provide wall mounting fire alarm panel pull stations with plaster rings where shown and as required and connect complete. Install each unit in a standard 100 mm (4") square recessed outlet box. Provide specified tamper cover on pull stations as designated and to all pull stations in student areas.
- .6 Install ceiling mounted thermal detectors where shown on the drawings and as required and connect complete. Secure the baseplate of each new detector to a recessed 100 mm (4") outlet box.
- .7 Provide ceiling mounted products of combustion detectors where shown on the drawings and as required and connect complete. Secure the baseplate of each detector to a 100 mm (4") outlet box or surface mounted as required. Where applicable, provide wiring in conduit and connections from smoke detector auxiliary relays to door hold open devices. Coordinate work of respective trades.
- .8 Mount each duct mounted products of combustion detector on the duct in question and connect with smoke sampling tubes which extend into the duct air stream. Install a remote alarm lamp assembly for each duct mounted detector. Wall mount each lamp assembly on a standard 100 mm (4") outlet box as close as possible or practicable to the detector. Do not locate duct detectors within 1 m (3') of duct size increaser or decreaser fittings or any duct elbow.
- .9 Note that type of detectors in areas where sudden rise of temperature may occur such as entrance vestibules, shall be confirmed with system manufacturer to suit application. Detectors used in non-climate controlled environments must be ULC listed for such application and be as recommended by system manufacturer.
- .10 Provide alarm speakers/strobes on standard device boxes in locations as shown and as required. Adjacent speaker shall be wired on parallel alternate circuits, with maximum ten (10) signal devices per circuit. Visual alarm devices integral with speakers shall be separately circuited from the speaker. Ensure that the sound levels are in accordance to the requirements of all applicable local Codes and as required by on-site audibility coverage tests. Provide required sound meters and personnel to perform tests. Adjust tapping, or relocate audible devices to suit, or provide additional devices, as required to provide audibility levels to satisfy testing.

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- .11 Provide fire alarm devices in genset enclosure and connect with required wiring in conduit. Connect to main building fire alarm system to annunciate as per fire alarm annunciator schedule but at least include for genset running, low fuel, common trouble and common alarm. Coordinate with genset vendor.
- .12 Provide flush wall mounting remote annunciator and adjacent graphic annunciator in location as shown. Unless otherwise noted, install in main entrance vestibule. Coordinate backbox installation with general trades work of the wall structure. Submit annunciator schedule with shop drawings. Verify zone nomenclature with Consultant prior to installation. Provide proposed drawing and sample of graphic display to Consultant for approval before manufacturing. Room names and numbers must be final versions approved by consultant and Owner in writing.
- .13 In application with hold open devices on doors, ensure compliance with NFPA regarding smoke detectors tied to hold open devices such that a signal received directly from the smoke detector must cause the release of door. Where electromagnetic locks are used on doors of egress, provide required automatic release of locks upon activation of fire alarm. Provide required connections to fire alarm system and to electromagnetic locks, and provide required contactors and/or relays for connection to control panel.
- .14 Provide voltage sensing relays in all the phases, line side, of the fire pump controller and standpipe system excess pressure pump starters to sense loss of line voltage. The relays shall be energized from 15A-1P breakers and shall be complete with "C" contacts, one (1) per phase, which, if any one (1) phase voltage drops below 90% of nominal, trouble alarm shall signal in the fire alarm system indicating "Fire Pump Loss of Voltage" or "Standpipe Excess Pressure Pump Loss of Voltage" at all annunciators.
- .15 Provide an auxiliary N.O. contact in the fire pump controller and connect to the fire alarm annunciators, powered from the fire alarm system to indicate "Fire Pump Running."
- .16 In addition to wiring connections to fire alarm system components, extend control wiring in conduit from the control panel to (where applicable):
  - .1 fire protection system piping alarm valves for alarm initiation;
  - .2 fire protection system piping supervised valves for trouble initiation;
  - .3 fire protection piping pressure sensors for loss of pressure trouble indication;
  - .4 fan equipment starters;
  - .5 door holders;
  - .6 telephone system key switch for connection to offsite central monitoring station;
  - .7 fire pump transfer switch;
  - .8 genset control panel;
  - .9 elevator controllers;
  - .10 dimming systems;
  - .11 security system.
- .17 Unauthorized closure of a fire protection system piping supervised valve shall cause the location of the closed signal (audible and visual) to sound and illuminate, and a trouble signal to be transmitted (via a future connection) to the Fire Department or to an outside protection agency.
- .18 Low pressure in the fire protection piping mains (wet and dry), fire protection system pumps (fire pumps - standpipe system excess pressure pump - sprinkler pump, sprinkler system excess pressure pump) loss of power, or operation of the fire pumps shall also activate audible and visual trouble alarm as specified above for supervised alarms.



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- .19 Provide end-of-line resistors as required to electrically supervise all standard device wiring. Generally, locate end-of-line resistors 50 mm (2") below ceiling lines above a pull station location.
- .20 Refer to the drawing riser diagram. Quantities of components shall be as per the floor plans and not the riser diagram. Note that additional quantity of devices shall be provided if the system testing determines a need for such.
- .21 Confirm the exact location of all components prior to roughing-in. Where applicable, confirm component finishes with Consultant prior to ordering.
- .22 Install all wiring in conduit. All wiring connections associated with the fire alarm system shall be performed on terminal strips in junction boxes. When pulling wires into conduit, use lubricant and ensure that wires are kept straight and are not twisted or abraded. Neatly secure exposed wires in apparatus enclosures with approved supports or ties. All wires must be clearly identified at all termination points. In addition they shall be numbered with Brady Ltd. or Electrovert Ltd. Z-type markers. Colour conductors for each part of the system in accordance with the system equipment manufacturer's recommendations.
- .23 Alarm signalling circuits (speakers/strobes) and alarm receiving circuits (pullstations, detectors) must be run in separate conduits from each other. All wiring connections shall be performed on terminal strips in junction boxes. Conduit couplings for fire alarm system wiring shall be painted red.
- .24 Where required by Code and/or local authorities, that the power and wiring connections to the control panel and annunciator and from the control panel to the annunciator shall be 2 hour fire rated, ULC listed, mineral insulated copper sheathed, copper conductor cable or provided in conduit within slab to provide code required fire rating.
- .25 Provide engraved Lamacoid identification nameplates for each equipment or wiring housing and secure to the front of the housing. Exact wording designations and sizes to be reviewed and confirmed with the Consultant prior to manufacture.
- .26 Verify nomenclature of the annunciator identification with the Consultant and obtain necessary approvals prior to ordering.
- .27 All work in conjunction with this installation shall meet the requirements of the latest editions of the OBC, OESC, ULC Installation Standard CAN/ULC-S524 and any applicable local codes. If any requirements of these specifications are different, omitted or contrary to the ULC-S524 Standard, then the ULC Standard governs and overrides these specifications, but in no instance will the standards established by the drawings and specifications be reduced by any of the Codes referred to previously. Control units and annunciators shall be in accordance to the latest requirements of ULC Standard CAN/ULC-S527 "Control Units For Fire Alarm Systems."
- .28 Sprinkler system alarm valve alarm zones shall be separate from manual station, thermal detector and products-of-combustion detector devices which may be connected together into zones.
- .29 Provide any required double voltage relays for fire alarm wiring work.
- .30 The system manufacturer shall provide testing and verification of the installed system in ensuring fuel responsibility for final certification of the system.
- .31 Submit to Consultant for approval, the proposed schedule for testing and verification of the system. Obtain such approvals prior to start of testing. The Consultant and/or other Owner's representatives shall have option to witness all or part of the testing and verification work. Notify Consultant and Owner minimum seven (7) working days in advance of testing.
- .32 When all fire alarm system work is complete and ready for acceptance, arrange for system manufacturer's authorized technician to inspect test and verify the equipment, including initiating devices, signalling devices, control devices and wiring. The inspection shall comprise an examination of such equipment in accordance with the latest editions of CAN/ULC-S537 for the following:

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- .1 to ensure that the entire system functions in accordance with the sequence of operations on the drawings and as specified;
  - .2 to ensure that the type of equipment installed is that designated by the contract documents;
  - .3 to ensure that the wiring connections to all equipment components show that the installer observed ULC and CSA requirements;
  - .4 to ensure that the equipment was installed in accordance with ULC S524 and the manufacturer's recommendations, and that all signalling devices of whatever manufacture were operated or tested to verify their operation;
  - .5 to ensure that the supervisory wiring of those items of equipment connected to a supervised circuit is operating and that the governmental regulations, if any, concerning such supervisory wiring, have been met to the satisfaction of inspecting officials;
  - .6 to ensure that all devices are commissioned and operable.
- .33 During the period of inspection and verification, make electricians available to the manufacturer to do any required correction work and to assist during inspections. Repair or replace failed devices to Consultant's satisfaction and local fire inspector's satisfaction. Include for manufacturer's technician to provide the re-verification and re-inspections of the deficiencies.
- .34 Be also responsible for, but not be limited to the following:
- .1 coordinate with local fire authority inspector the required testing and verification work in order to obtain certification and meet local fire code and local fire authority requirements;
  - .2 test and verify any connections to integrated systems/equipment;
  - .3 test system battery power supplies and audible devices, and demonstrate that their performance complies with specifications and code requirements;
  - .4 provide full detailed test sheets of all tested components and provide certification that system has been fully tested and is in proper work order in compliance to code requirements and the project documents.
- .35 The Contractor in coordination with the system manufacturer, shall contact local fire authority inspector and coordinate and arrange for the Fire Inspector to perform all required inspections. Integrate the local fire authority inspection requirements with the testing and verification work of the system manufacturer to extent as per Fire Inspector's directions. Obtain from local fire authority the required certificate of approval of the system and forward to Consultant.
- .36 On completion of the verification, inspection and testing of the system, obtain from the system manufacturer and forward to the Consultant, a verification certificate together with detailed inspection reports listing each and every system component, its location in the building and its acceptability. The verification certificate and inspection reports shall be prepared and signed by the manufacturer's authorized testing technician, confirming that the system is installed in accordance with requirements specified above.
- .37 Obtain from the system manufacturer and forward to the Consultant, a certificate of liability insurance, of at least the amount of two million dollars (\$2,000,000.00). The Certificate of Liability Insurance shall be registered for this project and shall be supplied to show satisfactory proof of the manufacturer's coverage for both its product and personnel.
- .38 Ensure that all costs for the above testing, verification and certification are included in the Bid Price. Include costs for re-verification of any failed device repaired or replaced.
- .39 Note that open flame and/or smoke are not to be used for testing.
- .40 The system manufacturer must employ technicians certified and approved for fire alarm system testing and verification by the Canadian Fire Alarm Association (CFAA) and the Ontario Fire Marshall as applicable.

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### 3.2 INSTALLATION OF SECURITY SYSTEM

- .1 Provide specified components for security system. Locate the control unit with LCD display unit, graphic display and alarm horn, and devices in locations as shown and as required. Connect with power wiring. Provide remote keypads at locations as shown. Confirm these locations with Consultant prior to roughing-in.
- .2 Be responsible for coordinating all aspects of the system which shall be supplied.
- .3 All wiring shall be installed in conduit unless otherwise noted and shall be FT6, Teflon coated. All wiring shall be tagged to provide ease of reference on the "as-built" drawings. Wire type shall be to the equipment manufacturers specifications.
- .4 All zoning designations shall be subject to the approval of the Consultant.
- .5 Provide key pads in locations as shown and/or directed.
- .6 Provide door alarm contacts flush in doors/frames as detailed on drawings and as coordinated with General Contractor and Consultant. Coordinate installation with trade providing doors/frames such that frames are supplied with integral boxes for mounting of contacts.
- .7 Mount motion detectors where shown and as required to provide suitable coverage of the areas in accordance with manufacturer's recommendations. Secure the base plate of each detector to a finish outlet box and connect with wiring. When decorating work is complete, adjust detector sensitivity as required and snap detectors into place.
- .8 Wire each detector, sensor and door alarm contact as a separate zone. Wiring shall be separate runs and not "daisy chained" to each device.
- .9 Confirm exact locations of all components prior to roughing in.
- .10 Provide system wiring in conduit from the security control panel to telephone equipment backboard for system monitoring via a ULC Listed Central Monitoring Station. Connect complete.
- .11 Provide wiring in conduit to integrate security system with low voltage lighting control.
- .12 Provide system wiring in conduit from fire alarm panel to the security control panel for connection of the fire alarm and trouble outputs.
- .13 The manufacturer's authorized technician shall test and verify the system.
- .14 Include costs for repairing/replacing failed devices and for re-verification of these devices.
- .15 Identify on as built at least the following:
  - .1 locations of central equipment and devices;
  - .2 expansion nodes; shall be installed in accessible locations in service areas such as mechanical rooms, LAN rooms and custodian room. Nodes shall not be installed in ceiling spaces.

### 3.3 PROVISIONS FOR MISCELLANEOUS SYSTEMS

- .1 Provide the following components to accommodate the installation of the telephone system and other systems by the system installers who will provide the equipment and wiring:
  - .1 conduit – diameters as sized on the drawings with suitable bushings for conduit terminations, and as specified in Section 16050;
  - .2 outlet boxes – standard galvanized steel, each complete with a blank type faceplate;
  - .3 pull boxes, junction boxes and sleeves - as specified in Section 16050;
  - .4 backboxes – as required to suit respective system manufacturers component requirements.

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- .2 Provide pullboxes in conduit runs longer than 30 m (100') or having more than two (2) 90° bends. Pullbox sizes shall not be less than eight (8) times the entering conduit in length. Note that network cabling conduit and pull box requirements must comply with system manufacturer's instructions to meet EIA/TIA standards.
- .3 Leave conduits free and clear of all obstructions and terminate as shown. Equip terminations with bushing, and clearly identify each run. Provide fish wires in all empty conduit. Coordinate conduit home run requirements to specific devices, with respective system suppliers.
- .4 Confirm the exact requirements and locations of the equipment with the Consultant and the system installers prior to roughing-in. Ensure that conduit runs comply with cabling bending radii of respective systems.
- .5 Refer to the system riser diagram on the drawings.
- .6 Quantities for outlets shall be as per the floor plan drawing and not the riser diagram.

### **3.4 INSTALLATION OF INTERCOM SYSTEM**

- .1 Provide a complete, fully operational intercom system. Install devices in accordance with the manufacturer's instructions and recommendations to suit specific applications.
- .2 Flush wall mount recessed door station in back boxes in locations as confirmed with Consultant or indicated on the drawings. Interconnect door station complete and to power supplies. Interconnect system with door hardware. Where required, interconnect door station control wiring to door control operators such as electric strikes, electromagnetic locks, etc. Coordinate with hardware supplier. Provide required wiring in conduit.
- .3 Master station shall be surface wall mounted mounted in the General Office. Connect complete with required wiring in conduit.
- .4 Program system to suit Owner's requirements.
- .5 Run system wiring in conduit. Home run door station wiring back to master station.
- .6 Co-ordinate work with trades supplying doors and door hardware. Co-ordinate work with trades responsible for construction in which stations are mounted.
- .7 After installation is complete, test, adjust and verify operation of system. Demonstrate system operation and maintenance with Owner's staff.

**END OF SECTION 16700**

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## SECTION 16750 – TELECOMMUNICATION SYSTEMS

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### PART 1 - GENERAL

#### 1.1 REFERENCES

- .1 Section 16010 applies to and is a part of this Section.

#### 1.2 RELATED SECTIONS

- .1 Issued Architectural Specifications.
- .2 Other sections of the electrical specifications

#### 1.3 REFERENCE STANDARDS

- .1 Work shall comply with the latest editions of the following:
  - .1 TIA/EIA 568-B Commercial Building Telecommunications Cabling Standards, including 568-B.1/568-B.2/568-B.3 and addenda.
  - .2 ANSI/NECA/BICSI 568-2001 Standard for Installing Commercial Building Telecommunications Cabling.
  - .3 ANSI/TIA/EIA 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
  - .4 ANSI/TIA/EIA 607 Grounding and Bonding Requirements for Telecommunications in Commercial Buildings.
  - .5 ANSI/TIA/EIA 569 Commercial Building Standards for Telecommunications Pathway and Spaces.
  - .6 TIA/EIA TSB-36 – Technical Systems Bulletin – Additional Cable Specifications for Unshielded Twisted Pair Cables.
  - .7 TIA/EIA TSB-67 – UTP End-to-end System Performance Testing.
  - .8 TIA/EIA 570B – Residential Cabling Standard;
  - .9 Latest BICSI standards (BICSI TDM Manual);
  - .10 Applicable local Building Codes.
- .2 All work must be installed by system manufacturer's certified system installers/vendors/business partners who are certified and experienced in implementing the selected data cabling system and to perform related testing programs.
- .3 The Contractor's final installation drawings must be reviewed by a Registered Communications Distribution Designer (RCDD).

#### 1.4 SUBMITTALS

- .1 Conform to requirements of Architectural Specifications.
- .2 Submit shop drawings for equipment and accessories specified in this Section. Include cabling, faceplate terminal cabinets, etc., and cabling testing sheets. Cabling shop drawings and data sheets must be reviewed and approved by the Consultant prior to ordering.
  - .1 Submit the following:
    - .1 proof that final installation drawings have been reviewed by a RCDD;
    - .2 sample of each type of data/voice jack complete with faceplate.

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- .3 sample of patchcord.
- .4 sample of labelling and proposed nomenclature;
- .5 sample of test sheet;
- .6 written confirmation that telecommunication system vendor is manufacturer's valid certified system vendor for at least duration of contract work and is in good standing at time of Bid submission;
- .7 copy of system manufacturer's warranty.

### 1.5 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and protect materials in accordance with requirements of Architectural Specifications.
- .2 Maintain packaged materials clean, dry and protected against dampness and intrusion of foreign matter.

### 1.6 WARRANTY

- .1 The system manufacturers shall provide a minimum 20 year full parts, labour and performance warranty on all passive components including the structural cabling system. These warranties shall be provided in written certificate form and shall guarantee the following:
  - .1 All passive system components, e.g. patch panels, UTP cable and outlet jacks, are free from manufacturing defects in material or workmanship;
  - .2 Approved cabling systems exceed the specifications of the TIA-EIA 568B.2.1 standards;
  - .3 The installation exceeds attenuation and near- end cross-talk, loss and bandwidth requirements TIA Bulletin TIA TSB-67;
  - .4 The installation will support the applications for which it was originally designed as well as future versions of the system performance specifications and any future applications using TIA/EIA 586B.2.1 component and cabling standards;
  - .5 The replacement or repair of any originally installed registered system component shall be completed at no cost for parts and labour to the Owner during the warranty period. Any components repaired or replaced shall be warranted for the remainder of the warranty.
- .2 The system manufacturers shall provide in writing to the Owner that in event of the demise or failure of the installing certified system installer/vendor, the manufacturer shall be responsible for providing another certified system installer/vendor to fulfil the remainder of the warranty conditions.
- .3 The Contractor shall provide a guaranteed 48 hours response time to any warranty claims.
- .4 Contractors must ensure that the selected network cabling component manufacturer and the wiring manufacturer must have contractual relationships to ensure that the system warranty is a true "end-to-end" structured cabling system warranty.

### 1.7 APPLICATION SUPPORT

- .1 The Structured Cabling System shall serve as a vehicle for transport of data, video and voice telephony signals throughout the network from designated demarcation points to outlets located at various desk, workstation and other locations as indicated on the drawings and described herein. Applications standards supported should include, but be not limited to:
  - .1 IEEE 802.3;
  - .2 10BASE-T;
  - .3 IEEE 802.5;

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- .4 4 Mbps;
- .5 16Mbps (328 ft [100m], 104 Workstations);
- .6 TP-PMD.
- .2 In addition, these links/channels shall be capable of supporting evolving high-end applications such as:
  - .1 100 Base-T;
  - .2 52/155 Mbps ATM;
  - .3 77 Channel Analog Broadband Video out to 550 MHz.
- .3 Gigabit cable performance shall be capable of supporting existing and evolving applications including:
  - .1 AES/EBU Digital Audio;
  - .2 270 Mbps Digital video;
  - .3 622 Mbps 64-CAP ATM;
  - .4 1000Base-T Gigabit Ethernet;
  - .5 1.2 Gigabit ATM.

### 1.8

#### SCOPE OF WORK

- .1 This Section shall provide minimum Standards for the provision of a structural cabling system to network the computer systems for the Complex. The requirements for the network electronics shall be the responsibility of the Owner's Network Integrator. The work of the telecommunication systems vendor shall include but not be limited to the following:
  - .1 provision of cabling system for a complete networking within the complex which can support the use of intelligent network switches with Network Management capabilities;
  - .2 organized wiring in a structured cabling system using point to point distribution system incorporating modular terminations;
  - .3 provision of data and voice cabling, data and voice communications outlets, patchpanels and associated equipment;
  - .4 provision of fibre optic cabling for risers and intra-building backbone between LAN closets and for applications as noted on drawings; use of fibre optic backbone cabling to augment system if more than one (1) network switch is used and the distance between switches exceeds 90 m (295') and for applications as shown and as required by BICSI standards;
  - .5 systems testing and verification;
  - .6 coordination of system requirements and integration requirements with integrated systems.
- .2 The local area network system must be "protocol neutral" and provide users access into a variety of resources from any location within the Complex. An Ethernet backbone shall be utilized for the system with network switches coordinating and managing data flow. The wiring configuration is based on a "physical star" topology in which cabling runs emanate in a radial pattern from the main data communications room in which the network switches are located.



**PART 2 - PRODUCTS**

**2.1 FIBRE OPTIC CABLE AND TERMINATION EQUIPMENT**

- .1 Intrabuilding (within buildings) the Belden CDT “FiberExpress – Distribution” Series ” multimode fibre optic cabling with the following specifications:
  - .1 UL listed, OFNR/CMR riser rated, tight buffered;
  - .2 multi strand multimode laser optimised fibre optic cabling; (refer to drawings for number of strands);
  - .3 multi-mode fibre to be 50/125 µm;
  - .4 terminated with type SC connectors but which must be confirmed with Owner and Consultant prior to start of work.
- .2 The 50/125 µm multimode fiber optic cable shall support single-channel serial transmission to 10 gigabits per second (Gb/s) for a distance of 300 meters. The cable shall be backward compatible with legacy applications such as:
  - .1 Ethernet;
  - .2 Token Ring;
  - .3 FDDI;
  - .4 Fast Ethernet;
  - .5 ATM.
- .3 The 50/125 µm multimode fiber optic cable shall support 10 Gb/s short wavelength (850 nm) emerging technology applications using vertical cavity surface emitting lasers (VCSELs) and low bit rate LED applications for legacy systems. It shall be optimized to control differential mode delay (DMD) so that “pulse splitting” at 10 Gb/s is eliminated.
- .4 The 50/125 µm multimode fiber optic cable shall meet or exceed the following standards, as applicable, for Plenum cables: ICEA S-83-596, ISO/IEC-794, GR-409, EIA/TIA 455, EIA/TIA 492, EIA/TIA 568-B, ANSI-FDDI, IEEE 802, UL 910, OFNP classification as described in the National Electric Code (NEC2), OFN-LS Low Smoke Cables, CSA Certified (OFN FT4/FT6) and SYSTIMAX SCS approved component industry standards.
- .5 The 50/125 µm multimode fiber optic cable shall comply with the Laser Optimized Multimode Fiber specifications in ANSI/EIA/TIA 492AAAC as well as the OM3 specifications in ISO/IEC 11801 2<sup>nd</sup> Edition and EN50173 2<sup>nd</sup> Edition.
- .6 Provide flexible PVC inner duct for installation in conduit, suitable for fibre optic cabling installations. Refer to details on drawings.
- .7 Provide plenum CMP rated cabling for applications as required by local authorities and codes.
- .8 Provide Belden CDT “Fibre Express” series panel suitable for multimode fibre optic cabling. Provide termination to accommodate the required number of fibre strands. Panel shall be complete with SC fibre connectors (exact type to be confirmed prior to start of work with Consultant/Owner), sliding tray with storage drums, plexiglass cover and wire management trough that attaches to front of shelf Provide panel loaded with quantity of fibre strands being terminated and allowing for a quantity of 30% additional spare adapters. Provide panel and accessories in black color finish. Mount in racks in accordance with manufacturer’s instructions.
- .9 Fibre optic patch cords shall Belden CDT “Fibre Express” series patchcords with SC fibre connectors (exact type to be confirmed prior to start of work with Consultant/Owner) and of length to suit application. Colour requirements shall be confirmed with Consultant/Owner prior to ordering.

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### 2.2 COPPER CABLING

- .1 Horizontal Cabling
  - .1 The horizontal cabling to voice/data outlets shall be Belden CDT “IBDN 2400” series, UTP cable and shall comply with TIA/EIA TSB-36 requirements for category 6 transmission. The cable specification shall be:
    - .1 Conductors: 4-pair, 23 awg. solid copper conductor, unshielded twisted pair.
    - .2 Cable grade: exceeds Category 6.
    - .3 Overall sheath: non-plenum CMR rated; jacketed outer sheath.
    - .4 Jacket colour: jacket colour for all horizontal and riser cabling associated with wireless access points shall be green, all other cabling shall be blue.
  - .2 The Category 6 system must exceed the ANSI/TIA/EIA 568-B.2-1 standard for a Category 6 4-connector channel. Demonstrate that the proposed manufacturer’s solution is guaranteed to exceed the Category 6 requirements across the entire swept frequency range of 1 – 250 MHz, by the margin as per base specified product. Manufacturers must submit with shop drawings, ETL test reports to verify full channel performance of the cable.
- .2 Riser Cabling
  - .1 For Cat 6 copper backbone and riser 50-pair cabling, provide double run of Belden CDT, 25 twisted pairs cabling consisting of Cat 6, CMR type, 24 awg copper conductors. Provide conduit sized to suit.
  - .2 For 50 pair Cat 3 copper backbone and riser cabling, provide Belden CDT, Cat 3, CMR rated, UTP cabling consisting of 50 unshielded twisted pairs of 24 AWG solid copper conductors insulated with color coded PVC.
  - .3 Incoming copper cabling shall be provided with suitable lightning protection devices. Refer to additional requirements later in this Section.
- .3 Provide plenum CMP rated cabling for applications as required by local authorities and codes.

### 2.3 COPPER CABLE TERMINATIONS

- .1 The “Structured Cabling Plan” is an end-to-end solution, which includes the data communications outlet and patch cord at the workstation and the patch panel and patch cords at the LAN room.

### 2.4 OUTLETS

- .1 Data/voice outlets shall be Belden CDT “Gigaflex PS6+” series and meet the following specifications:
  - .1 Flush wall mounting, to fit on standard recessed outlet box, complete with device bracket.
  - .2 Jack configuration: enhanced Category 6, eight-position, universal type, RJ-45 modular jacks, ISDN (T568A) pinned; constructed of high impact, flame retardant, thermoplastic;
  - .3 Keyconnect “Decora” style adapters for mounting of jacks; constructed of high impact, flame retardant, thermoplastic;
  - .4 Faceplates: “Decora” decorative style, screwless, high impact strength, thermoplastic/nylon construction to match those used for switches and socket outlets;
  - .5 Copper wires and connectors;

## SECTION 16750 – TELECOMMUNICATION SYSTEMS

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- .6 Outlet boxes to be standard 1104 box (approximately 2" x 4").
- .2 Confirm exact type of voice/data and facsimile outlet requirements with Consultant prior to ordering.
- .3 Quantity of jacks and configuration of faceplates shall be as detailed on drawings.
- .4 Colour finishes of jacks and faceplates shall generally be as per drawing detail, but which must be finalized and confirmed in writing with Consultant via shop drawing submission. Various colours shall be provided to differentiate systems.
- .5 Provide snap-in plastic dust covers on blank outlets and unused outlets.

### 2.5 PATCH PANELS AND TERMINATION BLOCKS

- .1 Belden CDT "Gigaflex PS6+" series, angled modular patch panels with features as follows:
  - .1 Cat 6 certified, 110 IDC technology;
  - .2 rack mounting hardware for patch panels to be rack mounted;
  - .3 wall mounting brackets and hardware for wall mounted units;
  - .4 24-port and 48-port RJ45 jacks, as required;
  - .5 circuit identification designation strip, snaps onto wiring block;
  - .6 horizontal trough for cables;
  - .7 distribution rings and ancillary devices as required.
- .2 Each jack connector module shall have a T568A (ISDN) eight pin RJ-45 jack on the front 110 connectors on back. The rack mounted panels shall mount onto standard EIA 19 inch equipment racks and shall have the capability to be stacked in larger systems. Horizontal data and voice cabling for various IDF shall terminate onto patch panels provided into floor standing equipment enclosures, as detailed and as required.
- .3 Incoming main telephone service cabling shall typically be terminated on 110 mounts and connectors. For other incoming telecommunication services, provide terminations to suit as confirmed with service provider. Capacity of connectors shall be to suit number of conductors. Exact type of termination means shall be confirmed and coordinated with the local carrier/provider. Mounts shall be suitable for wall mounting. For distribution through building, provide suitable termination devices for the backbone telephone cabling and fibre optic cabling, as required. Provide suitable lightning protection devices for incoming copper conductors.
- .4 The patch panel and termination block system shall include all required accessories such as bezels, harnesses, pigtails, connectors, jumpers, and retaining rings, interlay racking panels, horizontal wire managers etc., to provide for patch cord management.
- .5 Fibre optic type patch panels shall be as previously specified.

### 2.6 COPPER PATCH CORDS & CABLES

- .1 Copper data/voice patch cords shall be CDT "IBDN GIGAFLEX PS6+," modular, 23 awg. stranded copper, Category 6, CMP listed, ISDN wired with a length from 0.96 m to 4.6 m (3' to 15') as required. Provide patch cords in quantities to activate all ports.
- .2 Copper conductor modular pigtail assemblies, where required shall be Category 6 certified and with 8 pin modular plug.
- .3 Patch cords shall be factory terminated and tested.
- .4 Patch cords shall be provided in different jacket colours to suit system identification standard as directed by Consultant.

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### 2.7 EQUIPMENT ENCLOSURES

- .1 Enclosed type, equipment racks shall be heavy duty type, standard EIA 19" free standing and wall mounting enclosed relay racks complete with vertical cable management raceway and lockable doors.
- .2 The enclosed racks shall include the following requirements:
  - .1 Steel construction with ventilation fans and louvers as required
  - .2 Minimum 1800 mm (70") in height, with 4 posts design.
  - .3 Polyurethane finish or enamel painted finish.
  - .4 Double sided 12/24 tapped holes.
  - .5 Heavy duty base with provision for bolting to floor on floor standing units.
  - .6 Hinged swing gate for wall mounting rack enclosures.
  - .7 High capacity cable organizer channel with snap on cover.
  - .8 Full height front hinged lockable doors with handle operators with locks and keys.
  - .9 Full height vertical cable channels 150 mm x 150 mm (6" x 6") on both sides of rack at every one 1U.
  - .10 horizontal cable management channel – minimum one for each patch panel.
  - .11 Front and rear cable management provisions (typically only the last 150 mm (6") of cabling to connector shall be loose and not in channel).
  - .12 Rack mounted six (6) outlet power strips with surge protection, integral breaker, pilot light and power cord with twist lock type plug and receptacle provisions.
  - .13 All required mounting hardware, label kits, velcro style fasteners and ancillary devices.
- .3 Each rack shall include grounding provisions to meet previously listed standards, which include but are not limited to following provisions:
  - .1 copper ground strip mounted on side rail extending full height of rack;
  - .2 equipment jumper kits, to bond network equipment to rack ground strip;
  - .3 common bonding network to rack jumper kit, to bond rack to the room common bonding network;
  - .4 hardware including, copper compression HTAPS, paint piercing washer kits, bonding screws and electrostatic discharge port kits.
- .4 Wall mounted equipment racks shall be provided where required and shall be provided with similar applicable features as above, sized to suit application and with hinged feature to allow access to rear of rack as required.
- .5 The racks shall be of size and quantity to accommodate the respective number of patch panel ports to suit the number of required drops, the quantity of network electronic components as directed by Consultant, the uninterruptible power supply unit and an additional 20% spare capacity for future expansion.
- .6 Acceptable manufacturers include Belden CDT, CommScope, Hoffman, Panduit, DL Custom and Tyco AMP.

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### 2.8 ACCEPTABLE MANUFACTURERS

- .1 Acceptable network cabling system and component manufacturers shall include the following companies:
  - .1 Belden CDT;
  - .2 CommScope Systimax/Uniprise;
  - .3 Panduit;
  - .4 Tyco-AMP;
  - .5 Hubbell.

### 2.9 ACCEPTABLE CONTRACTORS

- .1 The telecommunication systems vendor selected for supply and installation of the structured cabling system shall provide confirmation of the following:
  - .1 detailed knowledge and experience in fibre optic and Category 6 UTP wiring installations;
  - .2 detailed knowledge and experience in the installation of intelligent network switch equipment.
  - .3 Experience in troubleshooting and problem solving in data communication networks.
  - .4 Ability to provide the warranties as supplied by the system manufacturers.
  - .5 BICSI certified.
  - .6 Of being system manufacturer's valid certified system vendor / business partner.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF NETWORK CABLING - GENERAL

- .1 Terminate cabling for villas onto wall mounted equipment secured to system backboards. The termination backboards shall be as detailed on drawings and provided with various telecommunication systems equipment as shown and as required. Provide power receptacles, ground bus and grounding and supporting hardware, as required. The main building telecom room shall be equipped with rack mounted termination components as required. Refer to other Sections for requirements of the other various telecommunication systems.
- .2 All cables must be properly handled and installed in accordance with the manufacturer's specifications. Undue pulling tension, abrasion or rough handling must be avoided to ensure that the cables will permit transmission exceeding the Category 6 design speed for data cables. All cables must be installed without splices or cuts to ensure the elimination of reflections, discontinuities, impedance mismatches, etc. The maximum horizontal length from the workstation to the network switch shall not exceed 90 m (295'). The maximum length of patch cables (either cross connects or interconnecting with electronic equipment to connect devices at the work area outlet), shall be a total of 10 m (30'). Maintain system manufacturer's minimum channel lengths as confirmed with system manufacturer. Provide cable loops in accordance with manufacturer's instructions.
- .3 Wiring shall be mechanically protected by runs in cable tray or in conduit. Conduit bends must comply with TIA/EIA bending radii restrictions.
- .4 Provide primary and secondary protection of the network from lightning surges or utility power disturbances as required.

## **SECTION 16750 – TELECOMMUNICATION SYSTEMS**

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- .5 No pull elbows are permitted. Only sweep or 90° elbows shall be utilized and no more than two (2) 90 changes in direction are permitted between pull boxes. The minimum radius of curvature shall be 10 times the conduit internal diameter. Maximum distance of conduit between two pull boxes shall be 100' (30m). Horizontal conduits not to exceed 25% fill ratio.
- .6 With consideration in minimizing alien crosstalk to levels as per BICSI standards and manufacturer's standards, dress all cables in a neat and orderly fashion from the entrance of the communications closet to the relay racks using vertical and horizontal cable management trays and paths.
- .7 Exposed conduits and junction boxes shall be primed and finish painted in colour approved by Owner.
- .8 Care shall be taken to ensure that during the installation, nicks, abrasions, burning and scuffing of cable is prevented. Cables found to be damaged will be replaced at the Contractor's expense regardless of whether the cable passes Cat 6 or fibre performance testing standards.
- .9 All bundled cables transitioning between floors (via cable tray, if shown) should be properly secured to vertical cable tray sections by Velcro straps. Waterfall (rounded transition) fittings shall be used for cable changing from a horizontal path to a vertical one. This maintains the minimum bend radius for CAT 6 cabling system. Also cables going through risers between floors must be properly supported for their weight, especially in situations with high pair count cables and large bundles.

### **3.2 INSTALLATION OF FIBRE OPTIC CABLE**

- .1 Provide fibre optic cable and inner duct for running in inner duct and conduit, as shown, specified and/or as required. Provide continuous runs, without splicing. Install in strict accordance with manufacturer's specifications. Fibre optic cable must be run in inner duct installed in conduit. Refer to riser drawing for run requirements.
- .2 Comply with manufacturer's minimum installation bend radius and minimum installed bend radius. Allow slack at sharp turns in cable run and immobilize cable at point of bend. The tension on the cable must be monitored during installation when pulling winches are used and shall not exceed tensile rating of cable. After installation, the only allowable tensile force on the cable should be that of its own weight. Terminate onto equipment terminations in accordance with manufacturer's requirements.
- .3 No more than two (2) 90° changes in direction are recommended for a single cable installed in conduit without pullboxes and not more than 50% fill ratio.
- .4 The attachments and grips for cable and installation temperature requirements shall be provided as specified by the manufacturer.
- .5 Provide fibre optic cabling termination trays as required for wall mounting and racks as required. Refer to drawing details.

### **3.3 INSTALLATION OF PATCH PANELS AND ACCESSORIES**

- .1 Review MDF/IDF details and provide components as required. Provide patch panels onto racks or wall mounted in LAN Rooms as required. Provide terminating hardware and connectors to suit incoming and outgoing cabling. Clearly identify each port. Provide patch cords as required. Install all devices in accordance with system manufacturer's requirements.
- .2 Provide patch cords and pig tails as required to extend between patch panels and from patch panels to Owner's network switch. Patch cords being connected to switch shall be handed over to Owner.
- .3 Bundle cabling in neat configuration and secure to patch panels and rack assemblies.

### **3.4 INSTALLATION OF TERMINATION HARDWARE**

- .1 Provide 110 connectors and mounts for main incoming telephone service, on hardwood backboards as shown. Design system layout to best suit incoming and outgoing cables. Properly punch down cabling with manufacturer's required tool and label each connector as required.

## SECTION 16750 – TELECOMMUNICATION SYSTEMS

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- .2 Run interconnect cables neatly secured and bundled across connectors and between banks of mounts. Use D-rings to their full advantage. Neatly bundle pigtailed and secure to 110 connectors. Provide suitable wiring from incoming telephone termination field to horizontal outlet runs voice patch panels.
- .3 Align mounts in straight formations to provide a neat installation and to minimize interconnect wiring lengths.
- .4 Provide 110 blocks and mounts in telecom room as shown, suitable for termination of the multi pair cabling. Provide patch panel and install in racks as shown. Make all terminations.

### 3.5 COPPER CABLE INSTALLATION

- .1 All horizontal, UTP cables shall be continuous from end to end with no splices. Horizontal cables shall be installed in Star topology, emanating from the rack mounted patch panel(s) and terminating on voice/data outlet faceplates in rooms or other workstation locations. The maximum length for horizontal cables shall not exceed 90 m (295'). The maximum length for patch cords at workstations shall not exceed 7 m (23'). The maximum length for patch cords at the patch panel shall not exceed 3 m (10').
- .2 Unless otherwise noted, all horizontal cabling shall be installed in conduit, surface raceways or run in cable tray. The drawing fill chart and following criteria must be met for conduit installation:
  - .1 For straight runs up to 15 m (50'), the cables may occupy up to 40% of the conduit area.
  - .2 For conduit runs between 15 m and 30 m (50' and 100') the cables may occupy up to 33% of the conduit area.
  - .3 For runs over 30 m (100'), the cables shall not exceed 25% of the conduit area.
  - .4 Each 90° conduit bend shall be considered as the equivalent to 9 m of conduit length.
  - .5 A pull box must be installed when more than the equivalent of two (2) 90° bends exist in the conduit run or if the run exceeds 38 m (125'); conduit runs shall not have more than 270° bends in path.
- .3 Conduits shall be installed following building lines. Under no circumstances shall conduits be fastened to suspended ceiling support systems. Conduits shall be supported to building structure independent of other support systems.
- .4 All conduit systems shall be left with a nylon fish string to allow for future additional cables.
- .5 Terminations shall involve as little outer jacket removal as possible and cable pairs "untwisting" shall not exceed 6mm (1/4").
- .6 Slack cable must be provided to allow for minor workstation relocations. A coil of slack cable of an approximate 2 m (6') length shall be provided for each workstation outlet run.
- .7 Provide conduit runs as required from various telecommunication equipment to integrate the systems.
- .8 For horizontal copper backbone cabling, 50 pair conductor cabling is preferred. If available only in 25 pair cabling, provide dual runs and increase conduit diameters to suit exact requirements of standards and codes.

### 3.6 PENETRATION THROUGH FIREWALLS

- .1 A conduit sleeve shall be provided where horizontal cables penetrate firewalls. The conduit sleeve shall be sized at 40% fill ratio with a plastic bushing at both ends.
- .2 After the conduit sleeve is installed, the opening around the conduit shall be filled with firestop and smoke seal materials.

## SECTION 16750 – TELECOMMUNICATION SYSTEMS

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### 3.7 INSTALLATION OF OUTLETS

- .1 Each data/voice outlet shall receive 4-pair, Category 6, rated cables. Each cable shall be tested and identified with the faceplate also identified. All outlets shall be mounted at heights noted on drawings or confirmed with Consultant prior to start of work. All jacks shall be wired and connected back to respective patch panels in closets.
- .2 Provide outlet jack/faceplate configuration as detailed on drawings.

### 3.8 SEPARATION OF DATA COMMUNICATION CABLES FROM SOURCES OF ELECTROMAGNETIC INTERFERENCE

- .1 All data communication cables shall be separated from sources of electromagnetic radiation in accordance with TIA Standard Proposal SP-2072 and the following:
  - .1 If both data and small power cables (2 KVA power circuits) are installed in grounded, ferrous metal conduit throughout their run, then no separation is required (i.e.: EMT conduit).
  - .2 CMP plenum rated data cabling with no metallic raceway and power conductors (2 KVA power circuits) in a grounded raceway requires 125 mm (5") clearance.
  - .3 For fluorescent luminaires, the required clearance is 300 mm (12").
  - .4 Clearance increases up to 600 mm (24") for power circuits over 5 KVA.
  - .5 For large motor, transformers, power panels, etc., the required clearance is 1 m (3').
  - .6 Cables must be routed to avoid direct contact with steam piping, hot water piping or other heat sources to avoid thermal degradation.

### 3.9 INSTALLATION OF EQUIPMENT ENCLOSURES

- .1 Provide equipment enclosures where shown on drawings and secure to wall/floor/ceiling as required.
- .2 In locations where more than one enclosure is required, butt multiple enclosures together. Provide wiring channel interconnection such that wiring from enclosure to another is not exposed.
- .3 Provide metal raceway chimney channel for all conductors extending down from ceiling, such that wiring is not exposed. Secure channel to enclosure and ceiling.
- .4 All wiring shall be run neatly bundled with wiring management channels. Do not over tighten Velcro tie straps such that they deform cable jacket. Velcro straps shall easily slide along length of cable. The straps used in plenum spaces shall be plenum rated.
- .5 Properly ground and bond enclosure and equipment to room ground bus as per specifications and to standards of TIA/EIA 607.

### 3.10 SYSTEM IDENTIFICATION

- .1 Confirm exact identification standards with Consultant and Owner prior to start of Work. The requirements herein are general and exact requirements must be confirmed and approved with Consultant.
- .2 A complete identification system shall be provided that clearly designates the following:
  - .1 The horizontal cable.
  - .2 The workstation (or faceplate).
  - .3 The horizontal/passive patch panel port.



## SECTION 16750 – TELECOMMUNICATION SYSTEMS

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- .4 The network switch/active patch panel port.
- .5 The patch cords.
- .3 Cable Identification
  - .1 Horizontal UTP cables shall be permanently identified at both ends in the following manner:
    - .1 "BUILDING/FLOOR/ROOM #1/PATCHPANEL #/PORT #"
    - .2 EXAMPLE: A cable in Building A, on floor 2, room 201, patch panel #1, port #12 shall be designated as 2/201/1/12.
  - .4 Faceplate
    - .1 Workstation faceplates shall be designated in an identical duplicate manner as cables. Faceplates shall be labelled with component manufacturer's labels. Confirm nomenclature with Consultant.
  - .5 Patch Panel And Patch Cord Identification
    - .1 Patch panel ports shall be identified in simple numeric form.
    - .2 Patch cords shall be identified at both ends in simple numeric form, not necessarily corresponding to port numbers.
  - .6 Identification Log
    - .1 All cable and workstation identification shall be recorded in a hard copy "CABLE IDENTIFICATION LOG" which is to be handed over to the Owner after cable testing and certification is complete. A duplicate copy is to be forwarded to the Consultant.
  - .7 Utilize Brother P-Touch or equivalent labeller. Data patch cables shall be labelled using Brady DAT-35-922 or equivalent self laminating labels. Label identification information shall be confirmed with Consultant and Owner's representative prior to start of work. IDC blocks shall be clearly labelled in ink in manner approved by Owner. Circuit numbers shall be clearly identified permanently on outside of conduit at both ends.

### 3.11 COORDINATION WITH NETWORK INTEGRATOR

- .1 Coordinate work with the work of the Owner's Network Integrator.
- .2 The Network Integrator must be present on-site to witness and coordinate the required system testing. The cabling Contractor and the Network Integrator must together perform a job walk through upon completion of testing, together sign the cabling test reports to verify that network cabling is properly installed and performs to acceptable Standards.

### 3.12 CABLE TESTING AND SYSTEM CERTIFICATION

- .1 The structured data cabling system certification shall include 100% cable testing and verification for a TIA/EIA Category 6 solution.
- .2 The verification of each cable shall be performed by the certified system vendor and shall be documented on a cable-testing sheet, which shall form part of the hard copy documentation supplied at the end of the installation. The testing sheets shall list the detailed performance test measurements as requested and as required to prove compliance with the referenced standards. Submit sample of test sheet with shop drawings.
- .3 Comply with manufacturer's testing and certification procedures.
- .4 Testing Procedures:

## SECTION 16750 – TELECOMMUNICATION SYSTEMS

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- .1 Testing shall be performed using a Scope Communications Agilent “Wire Scope 350”, or Fluke DSP 4000 series, Microtest Omni-Scanner 2 cable tester. The model of the cable tester shall be the most up to date at time of testing. Testing shall include, but not be limited to the following:
  - .1 wire map
  - .2 cable length;
  - .3 attenuation;
  - .4 near end crosstalk (next);
  - .5 power sum near end crosstalk (PSNEXT);
  - .6 equal level far end crosstalk (ELFEXT);
  - .7 power sum equal level far end crosstalk (PSELFEXT);
  - .8 return loss;
  - .9 ACR;
  - .10 power sum ACR;
  - .11 end to end continuity;
  - .12 opens or shorts;
  - .13 pair polarity.
- .2 All fibre testing shall be performed on all fibres in the completed end-to-end system. There shall be no splices unless clearly defined in an RFP. Testing shall consist of an end-to-end power meter test performed per TIA/EIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multi-mode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
- .3 For horizontal cabling system using multi-mode optical fibre, attenuation shall be measured in one direction at either 850 nanometer (nm) or 1300 nm.
- .4 Backbone multi-mode fibre cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in at least one direction.
- .5 Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-7 and/or ANSI/TIA/EIA-526-14 Standards, and to the manufacturer’s application guides.
- .6 Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements.
- .7 Acceptable loss measurements for 50 micron lazer optimized solution at 850 nm wavelength shall not exceed 2.5 db.
- .8 Since optical signal attenuation at one wavelength is independent of the attenuation at a second wavelength, the attenuation of the channel shall be measured at both standard wavelengths (850nm and 1300nm) for backbone links.

## **SECTION 16750 – TELECOMMUNICATION SYSTEMS**

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- .9 Submit detailed indexed test report in a 3- ring binder with covering letter from the company responsible for the installation and testing of the system stating the accuracy of the report. The letter shall be signed by the tester and company's authorized representative. Submit copy of systems manufacturer's certification of installed system.
- .10 Any cable not passing the testing procedure shall be replaced expeditiously and in its entirety. No splicing is permitted in the repair of any defective cable.

### **3.13 TELECOMMUNICATIONS ROOMS AND CLOSETS GUIDELINES**

- .1 Provide requirements as specified herein, and in compliance with TIA/EIA 607.
- .2 Fire retardant plywood shall be securely mounted on one wall in each telecommunications room or closet.
- .3 Ensure that all cable trays are grounded to the building electrical ground provided in each telecommunications room or closet. Note that the telecommunications ground is not to be used for this purpose.
- .4 Grounding shall be performed using copper conductor attached to the equipment rack and to the earth bus-bar using compression style lugs and suitable connectors which are designed to not induce electro-chemical potentials.
- .5 All equipment racks are to be firmly anchored to the floor. Racks bolted to the floor and racks bolted to the walls shall be properly grounded using copper wire in conjunction with appropriate connectors and non-corroding accessories. Detailed shop drawings for suggested method shall be provided to the Consultant for approval before construction.
- .6 Provide for all necessary drilling and anchoring components to be installed before any horizontal cable is installed.
- .7 All horizontal cable routing into the equipment racks must be neatly bundled using Velcro cable ties. The maximum number of cables per bundle will be 25.
- .8 The cable shall be protected from any obstructions using appropriate grommeting in the roof of the rack.
- .9 Provide grounding and bonding of system as per OESC and ANSI/EIA/TIA-607.
- .10 All metallic raceways for telecommunications equipment within the same room or space as the telecommunications main grounding busbar (TMEB) shall be bonded to the TMEB. Refer to Section 16400 for additional grounding and bonding requirements.

**END OF SECTION 16750**

## **SECTION 16850 – ELECTRIC HEATING**

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- 3.1 INSTALLATION OF ELECTRIC HAND DRYERS

## **SECTION 16850 – ELECTRIC HEATING**

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### **PART 1 - GENERAL**

#### **1.1 REFERENCES**

- .1 Section 16010 applies to and is a part of this Section.
- .2 Section 16050 contains requirements, products and methods of execution that apply to this Section, and is a part of this Section.

#### **1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- .1 The following work which is related to the electric heating work is specified in other Sections.
  - .1 thermal insulation on heat traced piping;

#### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings for equipment and accessories specified in this Section.

### **PART 2 - PRODUCTS**

#### **2.1 ELECTRIC HAND DRYERS**

- .1 Nova International, "Nova 4 – Airforce Plus" series, CSA approved, cUL listed and labelled, semi-recessed mounted electric hand dryers, with amperage and voltage ratings to suit application and available voltages (refer to drawings). Features include:
  - .1 each equipped with heavy duty overheat protected electric ball bearing motor;
  - .2 internally protected electric heating element;
  - .3 chrome plated adjustable nozzle to direct the air flow; nozzles to be complete with tamper resistant grilles;
  - .4 a 1-piece cast iron housing finished in porcelain enamel to Consultant's approval;
  - .5 tamperproof provisions and corrosion resistant internal parts;
  - .6 volume of air minimum 180 ft<sup>3</sup>/minute (5.2 m<sup>3</sup>/minute), at velocity of 5700 linear ft /minute (1700 linear meter/minute) average air velocity;
  - .7 drying cycle to be initiated automatically by an electronic sensor for "no-touch" operation and automatically stop when hands or head are moved away.
  - .8 recessed mounting galvanized steel backbox.
- .2 Acceptable manufacturers are Nova International, World Dryer Corporation, American Dryer and Bobrick.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION OF ELECTRIC HAND DRYERS**

- .1 Provide semi-recessed wall mounted electric hand dryers in washrooms as required. Mount onto recessed backboxes.
- .2 Confirm exact mounting heights and locations with the Consultant prior to roughing-in. Confirm exact colour finishes with Consultant prior to ordering.
- .3 When the installation is complete, check and tests the operation of each dryer and adjusts as required.

**SECTION 16850 – ELECTRIC HEATING**

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**END OF SECTION 16850**