

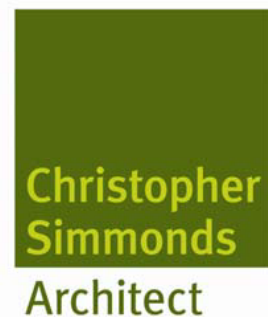
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**TOMLINSON  
NEW BUILDING  
4501 STRANDHERD DRIVE  
OTTAWA, Ontario**



574-15

**SPECIFICATIONS**



ISSUED  
November 14, 2016

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**END OF SECTION**

| <u>SECTION</u> | <u>TITLE</u> | <u>NO OF PAGES</u> |
|----------------|--------------|--------------------|
|----------------|--------------|--------------------|

**DIVISION 00 - Procurement and Contracting Requirements**

|                                       |   |
|---------------------------------------|---|
| *00 01 01 - Project Title Page .....  | 1 |
| *00 01 06 - List of Consultants ..... | 2 |
| *00 01 10 - Table of Contents .....   | 5 |

**DIVISION 01 - General Requirements**

|                                                                          |   |
|--------------------------------------------------------------------------|---|
| 01 00 10 - General Instructions .....                                    | x |
| 01 14 00 - Work Restrictions .....                                       | x |
| 01 33 00 - Submittal Procedures .....                                    | x |
| *01 35 21 - LEED Requirements .....                                      | 9 |
| 01 35 29 - Health and Safety Requirements .....                          | x |
| 01 45 00 - Quality Control .....                                         | x |
| 01 61 00 - Common Product Requirements .....                             | x |
| 01 73 00 - Execution .....                                               | x |
| 01 74 11 - Cleaning .....                                                | x |
| 01 74 21 - Construction / Demolition Waste Management and Disposal ..... | x |
| 01 78 00 - Closeout Submittals .....                                     | x |
| *01 79 00 - Demonstration and Training .....                             | 5 |
| *01 91 13 - General Commissioning Requirements .....                     | 5 |
| *01 91 31 - Commissioning Plan .....                                     | 9 |
| *01 91 33 - Commissioning Forms .....                                    | 3 |

**DIVISION 03 - Concrete**

|                                            |   |
|--------------------------------------------|---|
| *03 10 00 - Concrete Formwork .....        | 6 |
| *03 20 00 - Concrete Reinforcing .....     | 4 |
| *03 30 00 - Cast-in-Place Concrete .....   | 8 |
| *03 35 00 - Concrete Finishing .....       | 7 |
| *03 35 05 - Concrete Floor Hardeners ..... | 2 |

**DIVISION 04 - Masonry**

|                                                     |   |
|-----------------------------------------------------|---|
| *04 05 00 - Common Work Results for Masonry .....   | 5 |
| *04 05 12 - Masonry Mortar and Grout .....          | 2 |
| *04 05 19 - Masonry Anchorage and Reinforcing ..... | 3 |
| *04 22 00 - Concrete Unit Masonry .....             | 3 |

**DIVISION 05 - Metals**

|                                                  |   |
|--------------------------------------------------|---|
| *05 12 23 - Structural Steel for Buildings ..... | 5 |
| *05 21 00 - Steel Joist Framing .....            | 4 |
| *05 31 00 - Steel Deck .....                     | 6 |
| *05 50 00 - Metal Fabrications .....             | 5 |
| *05 51 21 - Metal Stairs .....                   | 5 |
| *05 73 10 - Glazed Guardrail System .....        | 7 |



## DIVISION 06 - Wood Plastics and Composites

|                                   |   |
|-----------------------------------|---|
| *06 10 00 - Rough Carpentry ..... | 5 |
| 06 20 00 - Finish Carpentry ..... | X |

## DIVISION 07 - Thermal and Moisture Protection

|                                                                 |    |
|-----------------------------------------------------------------|----|
| *07 11 13 - Bituminous Dampproofing .....                       | 4  |
| *07 21 13 - Board Insulation .....                              | 5  |
| *07 21 16 - Blanket Insulation .....                            | 3  |
| *07 21 19 - Foamed in Place Polyurethane Insulation .....       | 5  |
| 07 25 25 - U/V Weather Barrier .....                            | X  |
| *07 26 00 - Vapour Barriers .....                               | 3  |
| *07 27 10 - Air Barriers .....                                  | 4  |
| *07 42 20 - Formed Metal Wall Panels .....                      | 6  |
| *07 44 56 - Fiberglass Reinforced Concrete Panel Assembly ..... | 5  |
| *07 52 00 - Modified Bituminous Membrane Roofing .....          | 12 |
| *07 53 23 - Ethylene Propylene Diene Monomer Roofing .....      | 9  |
| *07 62 00 - Sheet Metal Flashing and Trim .....                 | 4  |
| *07 84 10 - Comprehensive Firestopping .....                    | 17 |
| *07 91 13 - Seismic Transition Strip .....                      | 3  |
| *07 92 10 - Joint Sealants .....                                | 5  |
| *07 95 13 - Expansion Joint Cover Assemblies .....              | 4  |

## DIVISION 08 - Openings

|                                                 |    |
|-------------------------------------------------|----|
| 08 11 00 - Metal Doors and Frames .....         | 10 |
| 08 11 16 - Aluminum Doors and Frames .....      | 9  |
| 08 14 16 - Flush Wood Doors .....               | 8  |
| 08 17 53 - Interior Glass Door Assemblies ..... | 5  |
| 08 31 00 - Access Doors - Architectural .....   | 3  |
| 08 36 13 - Sectional Metal Doors .....          | X  |
| 08 44 13 - Glazed Aluminum Curtain Walls .....  | 14 |
| 08 71 00 - Door Hardware .....                  | 9  |
| 08 71 99 - Schedule of Finishing Hardware ..... | 71 |
| 08 81 00 - Glass Glazing .....                  | 12 |
| 08 90 00 - Louvers and Vents .....              | X  |

## DIVISION 09 - Finishes

|                                               |    |
|-----------------------------------------------|----|
| 09 06 00 - Room Finish Schedule .....         | 13 |
| 09 21 16 - Gypsum Board Assemblies .....      | X  |
| 09 22 16 - Non-structural Metal Framing ..... | 5  |
| 09 51 13 - Acoustical Panel Ceilings .....    | X  |
| 09 53 00 - Acoustical Suspension .....        | X  |
| 09 65 16 - Resilient Sheet Flooring .....     | X  |
| 09 72 00 - Hygienic Wall Coverings .....      | 5  |
| 09 91 23 - Painting .....                     | X  |

## **DIVISION 10 - Specialties**

|                                              |   |
|----------------------------------------------|---|
| 10 26 10 - Corner Guards .....               | 2 |
| 10 28 10 - Toilet And Bath Accessories ..... | 9 |
| 10 22 39 - Folding Panel Partitions.....     | x |

## **DIVISION 11 - Equipment**

|                                                  |   |
|--------------------------------------------------|---|
| 11 13 13 - Loading Dock Bumpers .....            | x |
| 11 13 16 - Loading Dock Seals and Shelters ..... | x |
| 11 24 30 - Fall Protection Systems.....          | 6 |

## **DIVISION 12 - Furnishings**

|                                         |   |
|-----------------------------------------|---|
| 12 48 16 - Entrance Floor Grilles ..... | x |
|-----------------------------------------|---|

## **DIVISION 14 - Conveying Equipment**

**TBD**

## **DIVISION 21 - Fire Suppression**

|                                                     |   |
|-----------------------------------------------------|---|
| 21 05 01 - Common Work Results for Mechanical ..... | 3 |
| 21 07 20 - Thermal Insulation .....                 | 6 |
| 21 11 00 - Fire Protection Piping .....             | 4 |
| 21 12 00 - Standpipe and Fire Hose .....            | 3 |
| 21 13 00 - Sprinklers.....                          | 4 |

## **DIVISION 22 - Plumbing**

|                                       |    |
|---------------------------------------|----|
| 22 10 00 - Plumbing Piping.....       | 16 |
| 22 42 01 - Plumbing Specialties ..... | 5  |
| 22 42 02 - Plumbing Fixtures .....    | 5  |

## **DIVISION 23 - Heating, Ventilating and Air-Conditioning (HVAC)**

|                                                   |    |
|---------------------------------------------------|----|
| 23 05 53 - Mechanical Identification .....        | 3  |
| 23 05 93 - Testing, Adjusting and Balancing ..... | 5  |
| 23 21 00 - Hydronic Piping .....                  | 15 |
| 23 25 00 - Chemical Treatment for Piping .....    | 5  |
| 23 35 13 - Dust Collection .....                  | 4  |
| 23 36 00 - Air Terminal Units .....               | 4  |
| 23 37 00 - Air Outlets and Inlets .....           | 3  |

## **DIVISION 25 - Integrated Automation**

|                                            |   |
|--------------------------------------------|---|
| 25 05 01 - EMCS-General Requirements ..... | 6 |
| 25 90 00 - Sequence of Operations .....    | 5 |

## **DIVISION 26 - Electrical**

|                                                                      |    |
|----------------------------------------------------------------------|----|
| 26 05 00 - Electrical General Requirements.....                      | 6  |
| 26 05 20 - Wire and Box Connectors 0-1000v .....                     | 1  |
| 26 05 21 - Wires and Cables 0-1000v .....                            | 2  |
| 26 05 28 - Grounding - Secondary .....                               | 2  |
| 26 05 29 - Hangers and Supports For Electrical Systems.....          | 2  |
| 26 05 31 - Splitters, Junction, Pull Boxes, And Cabinets .....       | 1  |
| 26 05 32 - Outlet Boxes, Conduit Boxes, And Fittings .....           | 2  |
| 26 05 34 - Conduits, Conduit Fastenings, And Conduit Fittings.....   | 3  |
| 26 05 36 - Cable Tray for Electrical systems .....                   | 2  |
| 26 05 39 - Underfloor Raceways For Electrical Systems .....          | 2  |
| 26 05 43.01 - Installation Of Cables In Trenches And In Ducts.....   | 4  |
| 26 09 23.01 - Metering And Switchboard Instruments .....             | 4  |
| 26 09 43.13 - Digital-Network Lighting Controls .....                | 12 |
| 26 12 16 - Dry Type, Medium Voltage Transformers .....               | 2  |
| 26 24 02 - Service Entrance Board .....                              | 3  |
| 26 24 13 - Switchboards .....                                        | 2  |
| 26 24 17 - Panelboards Breaker Type.....                             | 2  |
| 26 27 26 - Wiring Devices .....                                      | 3  |
| 26 28 18 - Ground Fault Equipment Protection .....                   | 3  |
| 26 28 20 - Ground Fault Circuit Interrupters - Class A .....         | 1  |
| 26 28 21 - Moulded Case Circuit Breakers.....                        | 1  |
| 26 28 23 - Disconnect Switches - Fused And Non-Fused.....            | 1  |
| 26 29 02 - Fire Pump Control .....                                   | 2  |
| 26 29 10 - Motor Starters To 600 V .....                             | 2  |
| 26 36 23 - Automatic Transfer Switch With Bypass and Isolation ..... | 4  |
| 26 50 00 - Lighting .....                                            | 1  |
| 26 53 00 - Exit Signs .....                                          | 1  |
| 26 56 19 - Roadway Lighting .....                                    | 1  |

## **DIVISION 28 - Electronic Safety and Security**

|                                     |   |
|-------------------------------------|---|
| 28 31 01 - Fire Alarm Systems ..... | 3 |
|-------------------------------------|---|

## **DIVISION 31 - Earthwork**

|                                                       |   |
|-------------------------------------------------------|---|
| 31 22 13 - Rough Grading .....                        | 2 |
| 31 23 33.01 - Excavating Trenching and Backfill ..... | 3 |
| 31 32 19.01 - Geotextiles .....                       | 1 |

## **DIVISION 32 - Exterior Improvements**

|                                              |   |
|----------------------------------------------|---|
| 32 01 90 - Tree and Shrub Preservation ..... | 2 |
| 32 12 16 - Asphalt Paving .....              | 2 |
| 32 14 10 - Unit Paving .....                 | 3 |
| 32 15 40 - Crushed Stone Surfacing .....     | 2 |
| 32 17 23 - Pavement Marking .....            | x |
| 32 31 13 - Steel Fencing .....               | 4 |
| 32 31 29 - Wood Fences .....                 | 3 |

|                                                              |   |
|--------------------------------------------------------------|---|
| 32 32 56 - Riverstone, Armourstone, and Accent Boulders..... | 3 |
| 32 37 00 - Exterior Site Furnishings .....                   | 2 |
| 32 84 00 - Landscape Irrigation .....                        | 8 |
| 32 91 19.13 - Topsoil Placement and Finish Grading.....      | 3 |
| 32 92 20 - Mechanical Seeding .....                          | 3 |
| 32 92 19.16 - Hydraulic Seeding .....                        | 8 |
| 32 92 23 - Sodding .....                                     | 4 |
| 32 93 10 - Trees, Shrubs and Ground Cover Planting .....     | 7 |
| 32 94 14 - Plant Warranty and Maintenance .....              | 4 |
| 32 94 50 - Structural Soil Cells .....                       | 9 |
| 32 94 55 - Soil Cell Filler Soil and Planter Soil .....      | 6 |

**END OF SECTION**

**PART 1        General**

**1.01        RELATED SECTIONS**

- .1        01 33 00 – Submittal Procedures
- .2        01 74 21 – Construction / Demolition Waste Management.
- .3        01 91 13 – General Commissioning Requirements

**1.02        REFERENCES**

- .1        American Society of Heating Refrigeration and Air-Conditioning (ASHRAE)
  - .1        ANSI/ASHRAE 52.2-1999, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI approved).
- .2        American Society for Testing and Materials International (ASTM).
  - .1        ASTM E408-71(1996) Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
  - .2        ASTM C1371-04a Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
  - .3        ASTM E1918-97, Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
  - .4        ASTM C1549-04, Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
- .3        Canada Green Building Council (CaGBC)
  - .1        LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.
- .4        CSA International
  - .1        CAN/CSA-ISO 14021-00 (R2009), Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labelling).
- .5        Carpet and Rug Institute (CRI)
  - .1        CRI Green Label Indoor Air Quality (IAQ) Test Program - Green Label Testing Program.
- .6        Forest Stewardship Council (FSC)
  - .1        FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .7        Green Seal Environmental Standards (GS)
  - .1        GS-11-1993, Paints and Coatings.
- .8        Scientific Certification Systems (SCS)
  - .1        FloorScore Certification.
- .9        South Coast Air Quality Management District (SCAQMD), California State
  - .1        SCAQMD Rule 1113-2004, Architectural Coatings.
  - .2        SCAQMD Rule 1168-2005, Adhesives and Sealants Applications.

- .10 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
  - .1 ANSI/SMACNA 008-2007, IAQ Guideline for Occupied Buildings Under Construction.
- .11 U.S. Environmental Protection Agency (EPA) Compendium of Methods for the Determination of Pollutants in Indoor Air
- .12 United States Federal Trade Commission (US Federal Trade Commission)
  - .1 16 CFR Part 260-[2012[1]], Guides for the Use of Environmental Marketing Claims.

### 1.03 DEFINITIONS

- .1 FSC - Forest Stewardship Council.
- .2 CFC - Chlorofluorocarbons.
- .3 Chain-of-Custody Certification - certificates signed by manufacturers certifying that wood used to make products was obtained from FSC certified forests. Certificates include evidence that mill is certified for chain-of-custody by FSC-accredited certification body.
- .4 HCFC - Hydro Chlorofluorocarbons.
- .5 Rapidly Renewable Materials - materials made from agricultural products that are typically harvested within a ten-year or shorter cycle. Rapidly renewable materials include but are not limited to products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, and wool.
- .6 Regionally Manufactured Materials - materials that are manufactured within a radius of 800 km, if transported by truck, or 2400 km if transported by rail or water from project location. Manufacturing refers to the final assembly of components into the building product that is installed at project site.
- .7 Recycled Content - percentage by weight of constituents that have been recovered or otherwise diverted from solid waste stream, either pre-consumer or post-consumer.
  - .1 Wastes and scraps from manufacturing process that are combined with other materials after minimal amount of reprocessing for use in further production of same product are not recycled materials.
  - .2 Discarded materials from one manufacturing process that are used as materials in another manufacturing process are pre-consumer recycled materials.

### 1.04 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Design Submittals:
  - .1 Submit required letters, calculations, spreadsheets and templates prepared by Consultant for submittal to CaGBC.
  - .2 Submit additional LEED submittal requirements included in other sections.
    - .1 When submitted items are duplicated to that submitted to comply with other requirements, submit duplicate copies as separate submittals for compliance with indicated LEED requirements.
  - .3 Submit Project Cost Data: provide statement for total cost for building materials used for project. Exclude total cost of mechanical and electrical components and labour.
  - .4 Submit: LEED Action Plans: provide preliminary submittals within 14 days of date for start of Work indicating how the following requirements will be met.
    - .1 Materials and Resources Credit MR-2.1 Construction Waste Management: Divert 50% From Landfill and MR-2.2 Construction Waste Management:

- Divert 75% From Landfill prepare Construction Waste Management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Materials and Resources Credit MR-4.1 Recycled Content 10% (post consumer + ½ post-industrial) and MR-4.2 Recycle Content 20% (post consumer + ½ post-industrial)] Recycled Content.
- .1 Submit list of recycled content products used, including details of required percentages or recycled content materials and products, showing costs and percentages of [post-industrial] [post-consumer] content, and total cost of materials for project.
- .2 Submit verification documentation, when Supplementary Cementing Materials (SCMs) are used, certifying reduction in cement from Base Mix to Actual SCMs Mix, as percentage.
- .3 Materials and Resources Credit MR-5.1 Regionally Materials: 20% Extracted and Manufactured Regionally and MR-5.2 Regionally Materials: 30% Extracted and Manufactured Regionally
- .1 Submit list of proposed regionally manufactured materials and regionally extracted, harvested, and recovered materials.
- .2 Submit verification that project incorporates required percentage of 30%.
- .4 Wood Certification: submit vendor's Chain-of-Custody Certificate number for certified wood.
- .1 Submit vendor's FSC Chain-of-Custody Certificate number.
- .1 Provide list of products containing wood.
- .1 Indicate cost for all wood products excluding labour.
- .5 Indoor Environment Quality Credit IEQ-3.1 Construction IAQ Management Plan – During Construction and Credit IEQ-3.2 Construction IAQ Management Plan – Before Occupancy.
- .1 Submit Indoor Air Quality (IAQ) Plan for pre-occupancy and construction phases of construction.
- .6 Low-Emitting Materials:
- .1 Submit list of carpet, paints and coatings, flooring, adhesives and sealants used in building, showing compliance with VOC and chemical component limits or restriction requirements.
- .2 Submit list of laminate adhesives used in building, stating that they contain no urea-formaldehyde, composite wood products used in building, stating that they contain no added urea-formaldehyde resins.
- .7 Submit LEED Progress Reports: with Applications for Progress Payments, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
- .1 Materials and Resources Credit MR-2.1 Construction Waste Management: Divert 50% From Landfill and MR-2.2 Construction Waste Management: Divert 75% From Landfill. Submit Waste reduction progress reports in accordance with 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Materials and Resources Credit [MR-3.1 Materials Resource Reuse: 5% and MR-3.2 Resource Materials Reuse: 10%. Submit list of salvaged and refurbished materials.

- .3 Materials and Resources Credit MR-4.1 Recycled Content: 10% (post Consumer + ½ post-industrial) and 4.2 Recycle Content: 20% (post consumer + ½ post-industrial. Submit list of recycled content of materials.
- .4 Materials and Resources Credit MR-5.1 Regionally Materials: 20% Extracted and Manufactured Regionally and 5.2 Regionally Materials: 30% Extracted and Manufactured Regionally. Submit list of regionally manufactured materials and regionally extracted, harvested, or recovered materials.
- .8 LEED Documentation Submittals:
  - .1 Submit product data for roofing materials for Sustainable Sites Credit SS-7.2 Heat Island Effect: Roof indicating Solar Reflective [Index](#)<sup>[2]</sup> (SRI) of roofing materials as per ASTM E1918, ASTM E408-71(1996) ASTM E1980-01, ASTM C1371-04.
  - .2 Submit product data for lighting fixtures for Sustainable Sites Credit SS-8.0 Light Pollution Reduction. Submit data for exterior lighting fixtures.
  - .3 Submit product data for plumbing fixture for Water Efficiency Credits WEp1 Water Use Reduction and WE-3 Water Use Reduction: 40% Reduction. Submit Data for plumbing fixtures indicating water flow rates.
  - .4 Submit product data for Energy and Atmosphere Prerequisite EA-p3 Fundamental Refrigerant Management for CFC Reduction in HVAC R Equipment and Elimination of Halons.
    - .1 Include product data for new HVAC equipment indicating absence of CFC refrigerants.
  - .5 Submit product data for Energy and Atmosphere Credit EA-4 Enhanced Refrigerant Management.
    - .1 Submit calculations for the total Refrigerant Impact Calculation for new HVAC equipment.
  - .6 Submit product data for Energy and Atmosphere Credit [EA-5 Measurement and Verification]. Submit product data and wiring diagrams for meters and data collection systems for metering of building energy and water consumption performance.
  - .7 Submit Construction Waste Management Plan for Materials and Resources Credit MR-2.1 Construction Waste Management: Divert 50% From Landfill and MR 2.2 Construction and Waste Management: Divert 75% From Landfill. Comply with Section [01 74 21 - Construction/Demolition Waste Management and Disposal](#).
  - .8 Submit product data and certification letters for Materials and Resources Credit MR-4.1 Recycled Content: 10% and MR-4.2 Recycled Content: 20%. Submit product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for products having recycled content.
  - .9 Submit product data for Materials and Resources Credit MR-5.1 Regional Materials: 20% Extracted and Manufactured Regionally and MR-5.2 Regional Materials: 30% Extracted and Manufactured Regionally. Submit product data indicating location of material manufacturer for regionally manufactured materials. Include the following:



- .1 Statement indicating material cost, distance and mode of transportation from manufacturer to project for each regionally manufactured material.
- .2 Statement indicating cost and distance from point of extraction, harvest, or recovery to project for each raw material used in regionally manufactured materials.
- .10 Submit product data and certificates for Materials and Resources Credit MR-7 Certified Wood. Submit product data and certificates of chain-of-custody for products containing certified wood.
  - .1 Include statement indicating costs for products containing certified wood.
  - .2 Include statement indicating total cost for wood-based materials used for project.
- .11 Submit product data and shop drawing for Indoor Environmental Quality Credit EQ-1 Outdoor Air Delivery Monitoring. Submit product data and shop drawings for carbon dioxide monitoring system.
- .12 Provide submittals for Indoor Environmental Quality Credit EQ-3.1 Construction IAQ Management Plan, During Construction. Include the following:
  - .1 Construction indoor air quality management plan.
  - .2 MERV rating for temporary filtration media as per ASHRAE 52.2. used during construction period.
  - .3 Product data for filtration media installed before occupancy.
  - .4 Construction documentation submit 6 photographs at 3 different times during construction along with description of utilized IAQ measures in accordance with SMACNA, documenting protection of ducts and on-site stored or installed absorptive materials from moisture.
- .13 Provide submittals for Indoor Environmental Quality Credit EQ-3.2 Construction IAQ Management plan: Before Occupancy. Include the following:
  - .1 Signed statement describing building air flush-out procedures including start and completion dates of flush out and statement that filtration media was replaced after flush-out.
  - .2 Product data for filtration media used during flush-out and during occupancy.
  - .3 If testing is required, a report from testing and inspecting agency indicating results of IAQ testing and documentation showing conformance with IAQ testing procedures and requirements as per the US Environmental Protection Agency Compendium for the Determination of Indoor Air Pollutants.
- .14 Submit product data for Indoor Environmental Quality Credit EQ-4.1 Low-Emitting Materials: Adhesives and Sealants. Submit product data for interior adhesives and sealants indicating VOC content of product used. Indicate VOC content in g/L calculated in accordance with SCAQMD Rule 1168.
- .15 Submit product data for Indoor Environmental Quality Credit EQ-4.2 Low-Emitting Materials: Paints and Coatings. Submit product data for interior paints and coatings indicating chemical composition and VOC

content for products used. Indicate VOC content in g/L calculated in accordance with GS-11 SCAQMD Rule 1113.

- .16 Submit product data for indoor Environmental Quality Credit Low-Emitting Materials: Flooring Systems EQ-4.3 Low-Emitting Materials: Carpet. Include the following:
  - .1 Submit product data for carpet products indicating they meet the CRI Green Label Plus Program.
  - .2 Submit product data for carpet cushion indicating they meet the CRI Green Label Program.
  - .3 Submit product data for hard flooring indicating they meet the Floorscore standard.
  - .4 Submit product data for all flooring adhesives indicating they meet the requirements of Indoor Environmental Quality Credit EQ-4.1 Low-Emitting Materials: Adhesives and Sealants
- .17 Submit product data for Indoor Environmental Quality Credit EQ-4.4 Low-Emitting Materials: Composite Wood and Laminates Adhesives. Submit product data for composite wood and agrifiber products indicating products contain no urea-formaldehyde resins.
  - .1 Include product data for adhesives use in fabrication of laminated assemblies.
- .18 Submit product data and shop drawing for Indoor Environmental Quality Credit EQ-6.1 Controllability of Systems: Lighting. Submit product data and shop drawings for sensors and control systems used for individual task and shared multi occupant spaces lighting equipment.

## **1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.06 AMBIENT CONDITIONS**

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

## **PART 2 Products**

### **2.01 MATERIALS**

### **2.02 RECYCLED CONTENT OF MATERIALS**

- .1 Materials and Resources Credits MR4-1 Recycled Content: 10% (post-consumer + ½ pre-consumer) and MR4-2 Recycled Content: 20% (post-consumer + ½ pre-consumer). Supply building materials with a minimum post-consumer recycled content plus 1/2 pre-consumer recycled content of 20% of cost of project materials.
  - .1 Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of materials will be determined by dividing weight of post-consumer recycled

content plus one-half of pre-consumer recycled content in material by total weight of material and multiplying by cost of material.

- .2 Do not include mechanical and electrical components or labour in calculations.
- .3 Recycled content of materials in accordance with [16 CFR Part 260] [CAN/CSA-ISO 1402].<sup>[3]</sup> CAN/CSA-ISO 14021-00 (R2009), Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labelling)<sup>[4]</sup>

## 2.03 REGIONAL MATERIALS

- .1 Materials and Resources Credit MR5-1 Regional Materials: 10% Extracted and Manufactured Regionally. Supply 10% of building materials (by cost) that are regionally extracted, harvested, or recovered and manufactured.
- .2 Materials and Resources Credit MR5-2 Regional Materials: 20% Extracted and Manufactured Regionally. Regionally manufactured materials required by paragraph 2.3.1, supply 30% (by cost) of building materials that are regionally extracted, harvested, or recovered and manufacture.

## 2.04 CERTIFIED WOOD

- .1 Materials and Resources Credit MR-7 Certified Wood. Supply a minimum of 50% (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC Principles and Criteria.
- .2 Wood-based materials include but not limited to the following materials when made from made wood, engineered wood products, or wood-based panel products:
  - .1 Rough carpentry.
  - .2 Miscellaneous carpentry.
  - .3 Heavy timber construction.
  - .4 Wood decking.
  - .5 Metal-plate-connected wood trusses.
  - .6 Structural glued-laminated timber.
  - .7 Finish carpentry.
  - .8 Architectural woodwork.
  - .9 Wood panelling.
  - .10 Wood veneer wall covering.
  - .11 Wood flooring.
  - .12 Wood lockers.
  - .13 Wood cabinets.
  - .14 Non-rented temporary construction, including bracing, concrete formwork, pedestrian barriers, and temporary protection.

## 2.05 LOW-EMITTING MATERIALS

- .1 Indoor Environmental Quality Credit EQ4-1 Low-Emitting Materials: Adhesives and Sealants. Interior applications requiring adhesives, sealants and sealant primers must comply with SCAQMD Rule 1168.
- .2 Indoor Environmental Quality Credit EQ4-2 Low-Emitting Materials: Paints and Coatings. Interior applications use paints and coatings must comply with the following limits for VOC content when calculated according to SCAQMD Rule 1113 and GS-11.
- .3 Indoor Environmental Quality Credit EQ4-3 Low-Emitting Materials: Flooring Systems.

- .1 All carpet must be in compliance with the Carpet and Rug Institute's Green Label Plus Certification Program.
- .2 Hard surface flooring is to be in compliance with the Scientific Certification Systems FloorScore Program.
- .4 Indoor Environmental Quality Credit EQ4-4 Low Emitting Materials: Composite Wood and Laminate Adhesives. Do not use composite wood and agrifiber products or laminate adhesives that contain urea-formaldehyde resins.

### **PART 3 Execution**

#### **3.01 PREPARATION**

#### **3.02 CONSTRUCTION WASTE MANAGEMENT**

- .1 Credit MR-2.1 Construction Waste Management: Divert 50% From Landfill and MR-2.2 Divert 75% From Landfill. Comply with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **3.03 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT**

- .1 Credit EQ3-1 Construction IAQ Management Plan: During Construction. Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction.
- .2 Obtain written approval from Consultant to operate permanent HVAC systems during construction. Install MERV-8 filter media in accordance with ASHRAE 52.2 at return-air inlets
  - .1 Replace air filters immediately prior to occupancy. Replacement air filters to be MERV-13 in accordance with ASHRAE 52.2.
- .3 Credit EQ-3.2 Construction IAQ Management Plan: Before Occupancy.
  - .1 Conduct building air flush-out upon construction completion with new air filters by supplying a total air volume of 4,300 cubic metres of outdoor air per square metre (14,000 cubic feet of outdoor air per square foot) of floor area while maintaining an internal temperature of at least 16°C (60°F) and relative humidity no higher than 60%. Replace air filters after air flush-out. Replacement air filters to have a MERV-13 according to ASHRAE 52.2.
  - .2 If flush-out is not possible, Contractor to conduct baseline indoor air quality testing program according to U.S. EPA Compendium for the Determination of Pollutants in Indoor Air.
    - .1 Payment for testing in accordance with Section [from the IAQ Testing Allowance] [01 29 83 - Payment Procedures for Testing Laboratory Services] [Testing services will be paid by [Owner] [Departmental Representative] [Consultant] [DCC Representative]].
    - .2 Employ independent testing and inspecting agency to conduct IAQ Testing.

#### **3.04 ASSEMBLY**

- .1 NONE

3.05        **CLEANING**  
      .1        NONE

**END OF SECTION**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 Section 01 91 13 General Commissioning Requirements

### **1.2 SUMMARY**

- .1 This document provides a general overview of the Demonstration and Training procedure for this project.
- .2 The Contractor shall demonstrate scheduled operation and maintenance of equipment and systems to the Owner's personnel two weeks prior to the date of substantial performance.
- .3 The Owner will provide to the Contractor, a list of personnel (trainees) to receive instructions and coordinate their attendance at agreed upon times.

### **1.3 TRAINEES**

- .1 Trainees are personnel selected for operating and maintaining the facility.
- .2 Trainees include:
  - .1 Property/Facility Manager;
  - .2 Building Operators;
  - .3 Maintenance Staff;
  - .4 Security Staff; and
  - .5 Technical Specialists.

### **1.4 INSTRUCTORS**

- .1 The Design Team will provide:
  - .1 Descriptions of Systems; and
  - .2 Instructions on design philosophy, design criteria and design intent.
- .2 The Contractor will provide:
  - .1 Certified factory trained manufacturer's personnel as required;
  - .2 Demonstration and Instruction of equipment and systems regarding:

- .1 Start Up;
  - .2 Operation;
  - .3 Control;
  - .4 Adjustment;
  - .5 Troubleshooting;
  - .6 Servicing and Maintenance using the operation and maintenance manuals; and
  - .7 Shutdown.
- .3 Instruction will be provided on implications of operation, adjustment of set points and safety devices.
  - .4 The Instructor will review contents of the manuals in detail to explain aspects of operation and maintenance.

#### **1.5 TRAINING OBJECTIVES**

- .1 Training will be detailed to ensure:
  - .1 Safe, reliable, cost effective, energy efficient operation of systems in normal and emergency modes under all conditions;
  - .2 Effective on going inspection and measurement of system performance;
  - .3 Proper preventative maintenance, diagnosis and troubleshooting;
  - .4 Ability to update documentation; and
  - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

#### **1.6 TRAINING MATERIALS**

- .1 Instructors are required to prepare and provide the training manuals. The Instructors are responsible for training manual content and quality.
- .2 Training manuals will include:
  - .1 As Built Contract Documents;
  - .2 Operating Manuals;
  - .3 Maintenance Manuals;

- .4 Management Manuals; and
- .5 TAB and PV Reports.
- .3 The Instructor will prepare and insert additional data into the operations and maintenance manuals when needed for instruction.
- .4 Training manuals will be submitted for review 4 weeks prior to delivery of the training courses. Manuals will be reviewed by the Project Manager, Commissioning Authority and Property Manager.
- .5 Training materials shall be in a format that permits future training courses.
- .6 Training material formats should be provided in digital format and may be in the form of:
  - .1 Multimedia presentations;
  - .2 Manufacturers training videos;
  - .3 Equipment models; and
  - .4 Operating Manuals.

#### **1.7 SCHEDULING**

- .1 Training will be included in the Commissioning Schedule.
- .2 Training will be delivered during regular working hours unless other arrangements are agreed with the property manager.
- .3 Training sessions should not exceed 3 hours in length.
- .4 Training is to be completed prior to facility acceptance.

#### **1.8 RESPONSIBILITIES**

- .1 The Contractor is responsible for:
  - .1 Scheduling;
  - .2 Verifying conditions for demonstration and training instructions comply with requirements;
  - .3 Ensuring that equipment has been inspected and put into operation in accordance with the Project Requirements;
  - .4 Ensuring that testing, adjusting and balancing has been performed and equipment and systems are fully operational prior to demonstration and training;
  - .5 Implementation of training activities;



- .6 Coordination among instructors;
- .7 Quality of training materials; and
- .8 Quality of training.
- .2 The Project Manager, Commissioning Authority and Property Manager will evaluate training and materials.
- .3 The Instructor is responsible for verifying that designated personnel are present at training sessions. Attendance will be taken and an attendance log will be submitted with the training report.
- .4 Upon completion of training, the Contractor will provide a written training summary report signed by the Instructors and witnessed by the Commissioning Authority.

#### **1.9 TRAINING CONTENT**

- .1 Training provided by the Instructors shall use the installed equipment and systems.
- .2 Content Includes:
  - .1 Review of facility and occupancy profile;
  - .2 Functional requirements;
  - .3 System philosophy, limitations of systems;
  - .4 Emergency Procedures;
  - .5 Review of system layouts, equipment, components and controls;
  - .6 Equipment and system start up, operation, monitoring, servicing, maintenance and shut down procedures;
  - .7 System operating sequences;
  - .8 Maintenance and Servicing;
  - .9 Trouble shooting diagnosis;
  - .10 Interaction between systems during integrated operation; and
  - .11 Review of O&M documentation.
- .3 Provide specialized training as specified in the project specifications and contract requirements.

**1.10 VIDEO BASED TRAINING**

- .1 Manufacturers training videos may be used to supplement training materials. Such training tools shall be pre approved by the Project Manager, CA and Property Manager.
- .2 On Site training videos may be used:
  - .1 Video training sessions for use during future training;
  - .2 Taping of video training shall be performed only after systems are fully commissioned; and
  - .3 Videos shall be organized into several short modules to permit changes.
- .3 Production methods must be of professional quality.

**END OF SECTION 01 79 00**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 Section 01 91 31 – Commissioning Plan
- .2 Section 01 91 33 – Commissioning Forms
- .3 Section 01 79 00 – Demonstration and Training

### **1.2 SUMMARY**

- .1 This document provides a general overview of the commissioning process.
- .2 Commissioning is a planned program of tests; procedures and checks carried out systematically on systems and integrated systems of the finished Project. Commissioning is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.
- .3 Commissioning during the construction phase is intended to achieve the following specific objectives according to the contract documents:
  - .1 Verify that applicable equipment and systems are installed according to the manufacturer's recommendations, contract documents, design criteria, industry accepted minimum standards and that they receive adequate operational checkout by installing contractors;
  - .2 Verify and document proper performance of equipment and systems;
  - .3 Verify that O&M documentation left on site is complete; and
  - .4 Verify that the Owner's operating personnel are adequately trained.
- .4 The commissioning process does not remove or reduce the responsibility of the Contractor to meet the Contract Documents. The Contractor shall conduct the Commission process, operating equipment and systems, troubleshooting and making adjustments as required.
- .5 The Commissioning Authority will prepare a detailed commissioning plan.

### **1.3 COMMISSIONING SCHEDULE**

- .1 The Contractor shall prepare a detailed Cx Schedule as part of the

construction schedule.

.2 The schedule shall include adequate time for Cx activities including

- .1 Approval of Cx Reports;
- .2 Verification of Reported Results;
- .3 Repair, retesting, re-commissioning, re-verification; and
- .4 Training.

#### **1.4 COMMISSIONING MEETINGS**

- .1 The Contractor shall convene Cx meetings.
- .2 The purpose of the meetings is to resolve issues, monitor progress, identify deficiencies and review Cx test plans.
- .3 Cx meetings will be held on a regular basis until Cx deliverables have been addressed.
- .4 Cx meetings will be chaired by the Commissioning Authority (CA).
- .5 The Contractor shall ensure that relevant sub contractors and manufacturer's representatives are available at Cx meetings as required.

#### **1.5 START UP AND TESTING**

- .1 The Contractor assumes liability and costs for start up and testing of equipment and systems to be commissioned. Costs may include: disassembly and reassembly, starting, testing, balancing and include the supply of test equipment.

#### **1.6 COMMISSIONING TEAM ROLES AND RESPONSIBILITIES**

- 1. The Cx Team roles and responsibilities are defined in Section 01 19 31 Commissioning Plan Requirements.

#### **1.7 COMMISSIONING PLAN**

- .1 The Cx Plan requirements are defined in Section 01 91 31 Commissioning Plan.

#### **1.8 TRAINING**

- .1 The Training requirements are defined in Section 01 79 00 Demonstration and Training.

## **1.9 COMMISSIONING PROCESS**

- .1 Prior to formal commissioning, the Construction Contractor is expected to check, start up and verify the performance of each system. The Construction Contractor shall ensure that each step is completed prior to beginning a subsequent step. Further, the Construction Contractor shall ensure that any deficiencies, defects or repairs are tracked and completed prior to the start of formal commissioning.
- .2 For each system, the Construction Contractor shall:
  - .1 Confirm that the equipment is installed as per the approved shop drawings;
  - .2 Confirm that the equipment starts correctly;
  - .3 Confirm that the equipment functions correctly;
  - .4 Confirm that the equipment meets the required design performance;
  - .5 Confirm that the system as a whole, including the equipment, meets the required design performance; and
  - .6 Confirm that the system interacts correctly with other systems as per the design performance requirements.

## **1.10 DOCUMENTATION REQUIREMENTS**

- .1 Commissioning Documentation requirements are provided in Section 01 91 33 Commissioning Forms.

## **1.11 TEST WITNESSING**

- .1 The Construction Contractor shall:
  - .1 Advise the CA and Design Team seven (7) days in advance, in writing (email), for all verification, start up or testing; and
  - .2 Attend all tests performed by sub-trades, suppliers, manufacturers and/or specialists.
- .2 The CA and/or Design Team may choose to witness any field or factory testing.
- .3 The CA may select to attend any or all tests. Attendance will be based on:
  - .1 Equipment/System complexity/criticality;
  - .2 Number of similar equipment; and

- .3 Contractor performance record.
- .4 The CA and Design Team reserve the right to request re testing where:
  - .1 The submitted Cx forms are incomplete, inaccurate or the results are deemed questionable or unacceptable;
  - .2 Testing is conducted without previously advising the CA and Design Team; and
  - .3 Test results do not demonstrate required performance.

#### **1.12 TESTING REQUIREMENT AND SELECTIVE TESTING**

- .1 Every component and system is to be commissioned regardless of the number of similar components involved.
- .2 The contractor may apply to the CA and Design Team for Selective Testing. Selective testing may be considered for non critical repetitive equipment. Generally the first x systems shall be tested, then depending upon the success of the test results, sample testing may be employed to verify that installation standards are being maintained.
- .3 The CA and Design Team reserve the right to refuse the use of Selective Testing.

#### **1.13 MANUFACTURER/SUPPLIER TEST INVOLVEMENT**

- .1 Manufacturer`s representatives may be required to provide specialized technical support during the start up and commissioning process. This support may include:
  - .1 Factory Testing;
  - .2 Provision of installation instructions, operating procedures, maintenance plans etc;
  - .3 Site Verification;
  - .4 Site Performance Testing; and
  - .5 Site Training.
- .2 It is recommended that manufacturers are involved in the commissioning of all major equipment. The Design Team will identify the manufacture`s role in the commissioning process and will advise the CA accordingly. The CA may also advise on manufacturer involvement where appropriate.
- .3 The Construction Contractor is responsible for securing and scheduling the manufacturer`s representative(s) involvement during the commissioning process.

#### **1.14 MOCK UPS**

- .1 The Design Team will identify the areas where the Construction Contractor is to create mock ups prior to the installation of a large number similar systems or equipment. The CA may also advise on the use of mock ups where appropriate.
- .2 The Construction Contractor is responsible for implementing the mock ups as per the Design Team's requirements

#### **1.15 NON COMPLIANCE**

- .1 In general the Construction Contractor shall not submit test results to the CA until the test results meet the required performance requirements.
- .2 In the event that the test results are not compliant and the Construction Contractor believes that they have met their contractual obligations, the Construction Contractor shall notify the CA and the Design Team of the non compliance in writing. The Construction Contractor shall summarize the test results and describe the non compliance and offer an opinion of the root cause of the problems as well as suggested corrective action.
- .3 The CA will assist the Design Team in reviewing the non compliance and determining remedial action.

#### **1.16 TEST EQUIPMENT**

- .1 The Construction Contractor shall supply all equipment, instrumentation and resources necessary to conduct the start up and commissioning process.
- .2 The Construction Contractor shall compile and submit a complete list of all test equipment including serial numbers and calibration sheets to the CA.
- .3 Equipment requiring a calibration shall be maintained as per industry standards and the manufacturer's guidelines.
- .4 The CA and the Design Team reserve the right to request that the performance and calibration of measurement equipment is verified by an appropriate measurement body.

**END OF SECTION 01 91 13**

## **Part 1 General**

### **1.1 REFERENCES**

- .1 Section 01 91 13 – General Commissioning Requirements
- .2 Section 01 91 33 – Commissioning Forms

### **1.2 SUMMARY**

- .1 This document provides a general overview of the commissioning plan including roles and responsibilities of the Commissioning Team.
- .2 The Commissioning Plan will be prepared by the Commissioning Authority.

### **1.3 GENERAL**

- .1 The goal of the Cx plan is to help ensure that a fully functional facility is produced including:
  - .1 Systems, equipment and components meet the user's functional requirements and operate consistently within specified parameters and under normal loads.
  - .2 Owner Operation and Maintenance personnel have been fully trained in all aspects of the installed systems.
  - .3 Complete documentation is provided relating to the installed systems and equipment.
- .2 The Cx Plan is a master planning document for the Cx process.
- .3 The Cx Plan will:
  - .1 Outline organization, scheduling, resource allocation and documentation
  - .2 Defines responsibilities of Cx team members
  - .3 Defines Cx deliverables
  - .4 Describes process verification to meet Owner's requirements

### **1.4 DEVELOPMENT AND REFINEMENT OF THE Cx PLAN**

- .1 The Commissioning Authority will prepare the Cx Plan.
- .2 The Cx Plan will be submitted to the Owner/Project Manager for approval.



- .3 The Cx Plan is a living document and may be revised and updated to reflect the state of the project.
- .4 During the construction phase, the CA will revise, refine and update the Cx Plan to include
  - .1 Changes resulting from Client program modifications;
  - .2 Approved design and construction changes;
  - .3 Each revision will include revision numbers, dates and revision history; and
  - .4 Each revision will be submitted to the Owner/Project Manager for review.

#### **1.5 COMMISSIONING TEAM**

- .1 The commissioning team involves:
  - .1 Owner;
  - .2 An Independent Commissioning Authority (CA);
  - .3 Design Team;
  - .4 LEED Consultant (if applicable); and
  - .5 Construction Team.

#### **1.6 OWNER**

- .1 The Owner's role in the Commissioning (Cx) activities includes:
  - .1 Appoint a Commissioning Authority (CA);
  - .2 Review and Approve the Cx Plan;
  - .3 Ensure that the Design Team and Construction Team include Cx activities in their contracts;
  - .4 Assist in the preparation of the Owner's Project Requirements (OPR);
  - .5 Advise the CA of changes to the OPR;
  - .6 Review the Building Operations Manual (BOM);
  - .7 Attend formal training sessions; and
  - .8 Provide assistance for post occupancy commissioning.

## **1.7 COMMISSIONING AUTHORITY (CA)**

- .1 The CA's role in the Cx process includes:
  - .1 Review Owner's Project Requirements (OPR);
  - .2 Review Design Documents (Basis of Design);
  - .3 Advise and Support the Design Team with the preparation of Cx Specifications;
  - .4 Review Construction Documents with regards to the Cx process;
  - .5 Prepare Cx instructions;
  - .6 Review the contractor's Cx schedule;
  - .7 Track Cx progress;
  - .8 Review shop drawings with regards to Cx process;
  - .9 Review construction meeting minutes with regards to Cx process;
  - .10 Review submitted Cx forms for completeness and acceptability;
  - .11 Review Requests for Information, Site Instructions and Change Notices with regards to the Cx Process:
    - .1 Conduct Site Visits;
    - .2 Witness Site Testing;
    - .3 Review Mock Ups; and
    - .4 Assess Commissioning.
  - .12 Review Design Team Inspection Reports;
  - .13 Review Contractor's training program;
  - .14 Prepare a re-commissioning manual; and
  - .15 Prepare a Cx Report.

## **1.8 DESIGN TEAM**

- .1 The Design Team's role in the Cx process includes:
  - .1 Respond to the CA's document reviews;
  - .2 Include Cx Requirements in design specifications;

- .3 Provide code requirements for equipment and systems;
- .4 Provide information necessary to complete Cx forms;
- .5 Attend Cx meetings;
- .6 Witness selective testing with the CA;
- .7 Review as built drawings for accuracy and completeness;
- .8 Review TAB reports;
- .9 Provide narrative/descriptions and expected conditions for each system in the Building Operating Manual (BOM); and
- .10 Provide emergency operating and post emergency start up procedures.

#### **1.9 LEED CONSULTANT (if applicable)**

- .1 The LEED Consultant's role in the Cx process includes:
  - .1 Define LEED requirements and credits structure for the facility;
  - .2 Define LEED reporting requirements;
  - .3 Assist in the interpretation of LEED requirements for the purpose of commissioning;
  - .4 Provide instructions for LEED commissioning documentation and report submission; and
  - .5 Identify and interpret LEED credits that may require attention by the CA.

#### **1.10 CONSTRUCTION TEAM**

- .1 The Construction Team's role in the Cx process includes:
  - .1 Prepare a Start Up and Cx schedule;
  - .2 Obtain manufacturers installation, start up and operations instructions prior to start up of components, equipment and systems. This documentation shall be provided to the CA for review in advance of test plan preparation;
  - .3 Ensure that the Start Up and Cx schedule is completed in a timely manner;
  - .4 Raise Cx concerns with the CA and Design Team;
  - .5 Ensure that Start Up and Debugging is complete prior to commissioning;

- .1 Start Up;
- .2 Debug; and
- .3 Deficiency List.
- .6 Conduct Commissioning:
  - .1 Provide Resources (human, tooling, test equipment);
  - .2 Ensure Manufacturer or Specialist involvement where appropriate;
  - .3 Conduct Testing; and
  - .4 Conduct Adjusting and Balancing.
- .7 Prepare system information for inclusion in the Building Operations Manual (BOM);
- .8 Prepare As-Built-Drawings;
- .9 Ensure that all regulations and code references are current and applicable;
- .10 Prepare a training program and train all facility and O&M personnel;
- .11 Take remedial action as necessary to address Cx issues; and
- .12 Maintain Issues Deck of System Issues.

#### **1.11 SYSTEMS TO BE COMMISSIONED**

- .1 The Cx Plan will include a list of equipment to be commissioned.
- .2 Typical Mechanical systems to be commissioned include:
  - .1 Plumbing;
  - .2 HVAC and exhaust systems;
  - .3 Fire and Life Safety Systems;
  - .4 Noise and Vibration Control Systems;
  - .5 Seismic restraint systems;
  - .6 Indoor Air Quality and Control Systems; and
  - .7 Energy Metering Systems.

- .3 Typical Electrical systems to be commissioned include:
  - .1 High Voltage Switch Gear, Transformers and Distribution;
  - .2 Low Voltage Distribution and Systems;
  - .3 Central Clock Systems;
  - .4 Audio Visual Systems; and
  - .5 Electronic Data and Communications.
- .4 Typical Emergency Power Generation systems to be commissioned include:
  - .1 Generators;
  - .2 Fuel Systems;
  - .3 Transfer Switch Gear; and
  - .4 UPS and Batteries.
- .5 Typical Lighting systems to be commissioned include:
  - .1 Lighting Equipment;
  - .2 Distribution Systems;
  - .3 Emergency Lighting Systems; and
  - .4 Fire Exit Emergency Signage.
- .6 Typical Fire Alarm systems to be commissioned include:
  - .1 Annunciators;
  - .2 Control Panels; and
  - .3 Fire Alarm Battery Banks.
- .7 Other Systems may include:
  - .1 Security Systems.

#### **1.12 OPERATIONS AND MAINTENANCE INFORMATION REQUIRED**

- .1 Warranties
- .2 Project Records

- .3 Inventory of Spare Parts, special tools and maintenance materials
- .4 Maintenance Management System identification system
- .5 WHMIS information
- .6 MSDS data sheets
- .7 Electrical panel inventory detailing electrical circuitry for each panel board.

#### **1.13 Cx PROCESS DELIVERABLES**

- .1 Documentation for systems and equipment
- .2 Completed installation check lists
- .3 Completed product information report forms
- .4 Completed performance verification report forms
- .5 Results of Performance Verification Tests and Inspections
- .6 Description of Cx activities and documentation
- .7 Description of Cx of integrated systems
- .8 Training Plans
- .9 Cx Reports
- .10 Warranty Period activity reports
- .11 The Contractor will revise items on the Cx Forms to suit specific project requirements.

#### **1.14 PRE COMMISSIONING ACTIVITIES**

- .1 Activities required to be completed prior to the start of commissioning include:
  - .1 Pre Start Up Inspections;
  - .2 Use of approved check lists;
  - .3 Submittal of completed check lists to CA;
  - .4 Pre Start Up tests: pressure tests, flushing, cleaning and bumping as specified by the test plans; and
  - .5 Inclusion of all pre start up documentation in the Building

Maintenance Manual.

**1.15 PRE Cx ACTIVITIES MECHANICAL SYSTEMS**

- .1 Plumbing Systems:
  - .1 Bump each item of equipment in standalone mode;
  - .2 Complete pre start up checks and complete relevant documentation; and
  - .3 Test related equipment with control systems on a system by system basis.
- .2 HVAC Equipment and Systems:
  - .1 Bump each item of equipment in standalone mode;
  - .2 Complete pre start up checks and complete relevant documentation;
  - .3 Test related equipment with control systems on a system by system basis; and
  - .4 Perform TAB on systems. TAB reports to be submitted for approval.
- .3 EMCS:
  - .1 EMCS trending to be available as supporting documentation for performance verification;
  - .2 Perform point by point testing in parallel with start up;
  - .3 Carry out point by point verification; and
  - .4 Demonstrate performance of systems.

**1.16 PRE Cx ACTIVITIES ELECTRICAL SYSTEMS**

- .1 Provide independent testing to perform pre energization and post energization tests of electrical equipment as necessary
- .2 Test transfer switches by simulating loss of power. Verify availability of power at equipment.
- .3 Check UPS under full and partial load conditions
- .4 Test Emergency lighting systems by disrupting normal power
- .5 Test fire alarm systems after other safety and security systems are completed. Fire alarm system testing is to include a complete verification in accordance with CE requirements.
- .6 Test lighting control systems

.7 Test data communication systems

.8 Test Security, surveillance and intrusion alarm systems

**1.17 START UP ACTIVITIES**

.1 Start Up components, equipment and systems.

.2 Utilize equipment manufacture, supplier, installing specialists, as appropriate to start up under the contractor's direction.

.3 Rectify all start up deficiencies.

**1.18 PERFORMANCE VERIFICATION**

.1 Use procedures to suit project requirements.

.2 Performance Verification is performed by the Contractor.

.3 Performance Verification is witnessed by the CA.

**END OF SECTION 01 91 31**



## **Part 1 General**

### **1.1 REFERENCES**

- .1 Section 01 91 13 – General Commissioning Requirements
- .2 Section 01 91 31 – Commissioning Plan

### **1.2 SUMMARY**

- .1 This document provides a general overview of the commissioning forms required for Installation, Start Up and Performance Verification of systems and equipment.
- .2 The Commissioning Authority will provide the Contractor with a standard template for the creation of the Commissioning Forms.
- .3 The Contractor is required to prepare and complete commissioning forms for installation, start up and performance verification.

### **1.3 INSTALLATION AND START UP CHECK LISTS**

- .1 Check Lists shall include:
  - .1 Product Manufacturers installation instructions and recommended checks;
  - .2 Equipment manufacturer, model number and serial number;
  - .3 Special procedures as specified in relevant technical sections; and
  - .4 Any process or procedure required for installation, engineering or industry practice as deemed appropriate for efficient equipment or system operation.
- .2 Equipment manufacturer's installation/start up check lists may be used where applicable. Note: The Contractor is responsible for ensuring that all equipment check lists and procedures meet the contractual requirements of the project. Supplemental or additional data may be required to meet project conditions.
- .3 The Contractor shall use check lists for equipment installation.
- .4 Check lists shall indicate deficiencies and corrective action taken.
- .5 The Installer shall sign check lists upon completion, certifying stated checks and inspection have been performed.
- .6 Completed check lists shall be submitted to the Commissioning Authority.
- .7 Completed Check Lists are required prior to the start of Commissioning.

- .8 Check lists are required during Cx and will be included in the Building Maintenance Manual.

#### **1.4 PRODUCT INFORMATION (PI) REPORT FORMS**

- .1 Product Information Forms compile manufacturer information required for start up and functional testing. The forms are also used during operation and maintenance and will be included in the Building Maintenance Manual
- .2 Product Information Forms shall include:
  - .1 Name Plate Information;
  - .2 Parts List;
  - .3 Operating Instructions;
  - .4 Maintenance Guidelines;
  - .5 Pertinent Technical Data; and
  - .6 Recommended Checks.
- .3 Product Information Forms shall be submitted to the Design Engineer for Approval.

#### **1.5 PERFORMANCE VERIFICATION (PV) FORMS**

- .1 Performance Verification Forms shall be prepared and used by the Contractor for checks, running dynamic tests and adjustments carried out on equipment and systems.
- .2 PV forms are used by the Contractor to ensure correct operation, efficiency and independent function and interactive function with other systems as intend by the project requirements.
- .3 The Contractor shall review the PV forms with the Cx Team and CA a minimum of 10 days prior to performance verification.

#### **1.6 SAMPLE COMMISSIONING FORMS**

- .1 The CA will provide the Contractor with example Commissioning Forms in electronic format.
- .2 The Contractor will revise items on the Cx Forms to suit specific project requirements.

#### **1.7 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS**

- .1 When additional forms are required but are not available from the CA, the Contractor may develop appropriate verification forms and submit to

the CA for approval prior to use.

- .2 Additional Cx forms will follow the same format as provided by the CA.

## **1.8 COMMISSIONING FORM USE**

- .1 The Contractor shall use forms to verify installation and record performance when starting equipment and systems.
- .2 Forms shall be used in the following manner:
  - .1 The CA provides the Contractor with sample Cx forms;
  - .2 The Contractor will provide required shop drawing information and verify correct installation and operation of items indicated on the forms;
  - .3 The Contractor will verify operation as per the design criteria and intent;
  - .4 The Contractor will identify variances between design and operation and reasons for variances;
  - .5 The Contractor will verify operation in specified normal and emergency modes and under specified load conditions;
  - .6 The Contractor will record test data;
  - .7 The CA will verify reported results;
  - .8 Forms shall be signed by the recording technician and witnessed by the CA and
  - .9 Completed forms shall be submitted to the CA and original copies shall be filed in the Building Maintenance Manual.

**END OF SECTION 01 91 33**

**PART 1        General**

**1.01        RELATED SECTIONS**

- .1        Section 03 20 00 - Concrete Reinforcing.
- .2        Section 03 30 00 - Cast-In-Place Concrete.
- .3        Section 03 35 05 - Concrete Floor Hardeners.
- .4        Section 03 35 00 - Concrete Finishing

**1.02        REFERENCES**

- .1        Canadian Standards Association (CSA)
  - .1        CAN/CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.
  - .2        CAN/CSA-O86-09, Engineering Design in Wood (Limit States Design).
  - .3        CSA O121 (R2003), Douglas Fir Plywood.
  - .4        CSA O151-04, Canadian Softwood Plywood.
  - .5        CSA O437 (R2006), Standards for OSB and Waferboard.
  - .6        CSA S269.1-1975 (R2003), Falsework for Construction Purposes.
  - .7        CAN/CSA-S269.3 (R2003), Concrete Formwork.
  - .8        CAN/ULC-S701-05 Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .2        Council of Forest Industries of British Columbia (COFI)
  - .1        COFI Exterior Plywood for Concrete Formwork.
- .3        ACI
  - .1        ACI 302.1R.96 Guide for Concrete Floor and Slab Construction.

**1.03        SHOP DRAWINGS**

- .1        Submit shop drawings for formwork and falsework in accordance with Division 1.
- .2        Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, camber, special architectural exposed finishes, ties, liners, water stops, dovetail anchor slots, and locations of temporary embedded parts. Show size of tie hole, plastic plug, and plug recess. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
- .3        Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .4        Indicate sequence of erection and removal of formwork/falsework.
- .5        . Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .6        Assume full responsibility for complete design and engineering of formwork including shoring and bracing to resist loads due to wet concrete, forms, wind and other forces arising from use of equipment to place concrete.

**1.04 DELIVERY, STORAGE AND HANDLING**

- .1 Store materials on site in a manner to prevent damage thereto. Protect from weather. Comply with CSA A23.1, Clause 9.
- .2 Protect work of this Section from damage. Protect other work from damage resulting from this work. Replace damaged work which cannot be satisfactorily repaired.

**PART 2 Products**

**2.01 MATERIALS**

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121 and CAN/CSA-O86.1.
  - .2 For concrete with special architectural features, use formwork materials to CAN/CSA-A23.1 (09).
    - .1 New Sylvaform sealed overlaid plywood by MacMillan Bloedel Building Materials.
    - .2 Tubular column forms: round, spirally wound laminated fiber forms, internally treated with release material. Use seamless plastic liner for exposed columns.
- .3 Form ties:
  - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm (1") dia. in concrete surface.
- .4 For Architectural concrete:
  - .1 Form Ties: Threaded internal disconnecting, spreader type, adjustable in length. Ties to have maximum break back of 40 mm (1- ½") from concrete surface. Ensure ties incorporate removable tapered plastic spreader cones, with setback of 40 mm (1- ½"). Ensure taper of spreader matches taper of tie hole plugs. Wire ties not permitted.
  - .2 Tie Hole Plugs: Plastic set back plugs, grey to match concrete, 40 mm (1 – ½") setback, to fit tightly into tie holes. Include for tie hole plug quantity on basis of 1,000 mm (30") each way plug spacing pattern.
- .5 Form liner:
  - .1 Plywood: Douglas Fir to CSA O121 T and G.
- .6 Form release agent: non-staining, chemically active release agent containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing set of film of concrete in contact with form.
  - .1 For temperatures less than 0oC: Formwork Release Agent: Eucoslip by Euclid Admixture Canada Inc., C.R.A. by Sika Canada Inc., CPD Chemical Form Release Agent by CPD Construction Products or Duogard by W.R. Meadows of Canada Ltd.. For formed concrete work in contact with soil, use material that does not alter sulphate resistant qualities of concrete.
  - .2 For temperatures greater than 0oC: Water Based Formwork Release Agent: Eucsolip VOX by Euclid Admixture Canada Inc. or Sealtight Duogard II by W.R. Meadows of Canada Ltd.

- .7 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 0.75 mm to 1.00 mm (0.03 to 0.04 in) at 40°C, flashpoint minimum 150°C, open cup.
- .8 Falsework materials: to CSA-S269.1.
- .9 Sealant: to Division 7.
- .10 Waterstops: Extrusions of plasticized PVC low temperature compound to sizes and shapes indicated on drawings by W.R. Meadows of Canada Ltd., W.R. Grace and Co. of Canada Ltd., Coodco Ltd., CPD Construction Products or Sika Canada Inc.
- .11 Dovetail Anchors and Slots: Minimum 24 ga overall thickness zinc coating Z275 galvanized steel dovetail anchor slots with fillers to prevent entry of concrete during placing and minimum 14 ga overall thickness. Zinc coating Z275 galvanized steel dovetail anchors. Anchors shall project to within 20 mm (3/4") of masonry face.
- .12 Mechanical Fasteners: Galvanized steel screw and washer with screw of length to secure insulation to formwork without penetrating concrete finish surface.
- .13 Formwork Insulation: Extruded, expanded polystyrene, CAN/ULC-S701, Type 4, minimum RSI (R) value of 5.0 per 25 mm (1"), compressive strength 0.2 MPa (30 psi), thickness as indicated on Drawings.

## **PART 3 Execution**

### **3.01 FABRICATION AND ERECTION**

- .1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with drawings. Verify the locations of all inserts, anchor bolts, cast-ins, etc. with structural, architectural, mechanical, electrical, and shop drawings prior to proceeding with formwork. Report any discrepancies to Consultant immediately.
  - .1 Construct forms to produce plumb and level concrete and true to linear building lines. Maximum variations (not accumulative) as follows:
  - .2 Variation from plumb in concrete surfaces not to exceed 6 mm (1/4") in 3 m (10') nor 10 mm (3/8") in 6 m (20') or more.
  - .3 Variation from level or grade indicated on Drawings for tops of walls not to exceed 6 mm (1/4") in 3 m (10') nor 10 mm (3/8") in 6 mm (20') in building length.
  - .4 Variation of linear building lines from established position in plan and related positions of walls not to exceed 6 mm (1/4") in 3 m (10'), 10 mm (3/8") in 1 bay nor 25 mm (1") in building length.
  - .5 Variation of concrete slabs and toppings from dead level or slopes as indicated on Drawings not to exceed 4 mm (1/8") in 3 m (10').
- .2 Obtain Consultant's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.
- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.

- .8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
- .9 Align form joints and make watertight. Keep form joints to minimum.
- .10 Locate horizontal form joints for exposed columns 2,400 mm (8'-0") above finished floor elevation.
- .11 Use 25 mm (1") chamfer strips on external corners and/or 25 mm (1") fillets at interior corners, joints, unless specified otherwise.
- .12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .13 Camber:
  - .1 Provide upward slab and beam cambers as indicated on plans. Camber both the underside and the top of the concrete in a parabolic profile so as to maintain the structural thickness shown. Adjust cambers as directed by Consultant for "non-typical bays" based on the span and the support conditions.
  - .2 Prior to concreting verify formwork in place cambers by survey and report the results to the Consultant.
  - .3 Place, screed, and finish the slab concrete to specified beam and slab thicknesses. Verify thickness of slab/beams at midspan and support conditions. Verify cover to reinforcing steel at midspan and support conditions.
  - .4 Carry out surveying in accordance with Div 1. Cambers on subsequent floors may be adjusted to suit the actual behaviour of the first typical floor slabs under approval of Consultant. Repeat items 1-4 for all floors.
  - .5 Where not noted on plans, camber beams for Span/500 (span as defined as centerline of supports). Camber slabs for Span/400 in middle of bays (center of mid-strips) and Span/500 along column lines (center of column-strips).
- .14 Construct forms for architectural concrete to achieve the following:
  - .1 Water-tight forms at corners, panel joints, recesses, arises and at construction joints.
  - .2 Accurate alignment of concrete surfaces.
  - .3 Surfaces without indentations other than those indicated.
  - .4 Sharp and straight corners (unless other wise indicated).
- .15 Build in anchors, sleeves, ties, bolts, nailers, templates, shelf angles and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .16 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.
- .17 If slip forming and flying forms are used, submit details of equipment and procedures for Consultant's approval.
- .18 Use full size contact form sheeting panels wherever possible. Install contact surfaces of formwork to produce neat and symmetrical joint patterns. Ensure joints are vertical or horizontal and, where possible, stagger to maintain structural continuity. Back vertical joints solidly and nail edges of abutting sheets to same stud. Likewise solidly back horizontal joints. Ensure adjacent form panels fit accurately, tight and flush. Use straightest available lumber.
- .19 Align forms to ensure no visible defects appear on finished work.
- .20 Locate wall form ties in accordance with reviewed shop drawings; align on a particular member both vertically and horizontally. Arrange reuse of form so tie holes are also reused. Tighten form ties, particularly at corners.

- .21 Form slab soffits using full size panels where possible. Keep number of smaller size panels to minimum.
- .22 Take particular care in forming corners and openings. Ensure formwork is tight and braced so no movement occurs.
- .23 Use templates to secure and align anchor bolts in formwork prior to placement of the concrete. Report any interference with reinforcing or other inserts to Consultant prior to the placement of the concrete. Concrete should not be placed until interference issues are resolved in writing by the Consultant.
- .24 For walls and shear walls, leave one side of form open for review of reinforcing steel. Close form only after Consultant has reviewed bar placement.

### 3.02 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete. Proposed removal times to be approved by Consultant in writing prior to work. Contractor required to submit shop drawings/scheduling of proposed stripping time for all elements. Multi-storey slab construction to outline reshoring scheduling and methodology. All information to be stamped and certified by formwork Engineer.
  - .1 3 days for walls and sides of beams.
  - .2 3 days for columns.
  - .3 28 days for beam soffits, slabs, decks and other structural members, or 3 days when replaced immediately with adequate shoring to standard specified for falsework, and when concrete has reached at least 75% of specified 28 day strength.
  - .4 3 days for footings and abutments.
- .2 Remove formwork when concrete has reached 75 % of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Space reshoring in each principal direction at not more than 3,000 mm (10'-0") apart.
- .5 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.
- .6 Strip fibre forms off architectural concrete 2 days after placing, using power operated saw. To strip form, set power saw blade slightly less than thickness of the form, make 2 vertical cuts and remove form. Then, using broad bladed tool, carefully pry form off with short strokes by pushing handle toward column. Exercise care so not to mar concrete surface. After stripping, replace form halves on column and wire in place to protect column during construction. Leave around columns until after scaffolding and other formwork have been removed at end of construction to ensure column protection.
- .7 Be responsible for safety of structure, both before and after removal of forms until concrete has reached its specified 28 Day compressive strength.
- .8 Take particular care when removing forms to ensure no damage occurs at corners, arises and the like.
- .9 To help avoid colour variations in architectural concrete, ensure length of time between concrete placing and form removal is approximately same for each portion of work.
- .10 In hot weather, wood forms remaining in place should not be considered adequate for curing but should be removed or loosened so concrete surfaces may be kept moist or coated with curing agent.



- .11 In cold weather, defer removal of formwork or insulate formwork, to avoid thermal shock and consequent cracking of concrete surface.
- .12 Install tie hole plugs immediately following removal of spreader cones. Install to a snug fit, maximum setback from concrete surface as specified.
- .13 When concrete is dry, install temporary polyethylene rope in reglets to prevent contamination of same.

**3.03 CONSTRUCTION JOINTS**

- .1 Form construction joints where required and where indicated. Construction joints shall conform to CSA A23.1 (09). Construction joint locations to be approved by Engineer in writing prior to performance of work. See also Section 03 30 00.
- .2 Form 38 x 89 (2" x 4") beveled shear keys full length on construction joints, unless detailed otherwise.

**END OF SECTION**

**PART 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 03 30 00 - Cast-in-Place Concrete.

**1.02 MEASUREMENT PROCEDURES**

- .1 Reinforcing steel will be measured in pounds of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA-G30.18 for lengths and sizes of bars as indicated or authorized in writing by Consultant.
- .2 No measurement will be made under this section. Include costs in items of concrete work for which reinforcement is required.

**1.03 REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .2 American National Standards Institute/American Concrete Institute (ANSI/ACI)
  - .1 ANSI/ACI 315-80, Details and Detailing of Concrete Reinforcement.
- .3 American Society for Testing and Materials (ASTM)
  - .1 ASTM A 775/A 775M- 07b, Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4 Canadian Standards Association (CSA)
  - .1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
  - .2 CAN3-A23.3-00, Design of Concrete Structures for Buildings.
  - .3 CSA G30.3-M1983 (R1998), Cold Drawn Steel Wire for Concrete Reinforcement.
  - .4 CSA G30.5-M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
  - .5 CSA G30.14 M1983 (R1991), Deformed Steel Wire for Concrete Reinforcement.
  - .6 CSA G30.15-M1983 (R1998), Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
  - .7 CAN/CSA-G30.18-M-92 R2002, Billet-Steel Bars for Concrete Reinforcement.
  - .8 CAN/CSA-G40.21-04, Structural Quality Steels.
  - .9 CAN/CSA-G164-M-92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .10 CSA W186 (R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

**1.04 SHOP DRAWINGS**

- .1 Submit shop drawings including placing of reinforcement in accordance with Division 1.
- .2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada.

- .3 Detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated. Provide type B tension lap splices unless otherwise indicated.
- .4 Show walls (foundation/retaining/shearwall/corewall) in full elevation and indicate bar size, spacing, laps, bends, etc.
- .5 Show beams in full elevation and indicate bar size, spacing, laps, bends, etc. Beam reference labels to be used on shop drawings.
- .6 Show columns in full elevation and indicate bar size, spacing, laps, bends, etc.
- .7 Show slab reinforcing full length on drawings. Slab drawings to be provided as noted on separate sheets:
  - .1 Top Layer Reinforcing
  - .2 Bottom Layer Reinforcing
  - .3 Secondary Reinforcing (i.e. additional dowels/ties/bars at inserts/integrity steel)
  - .4 Slab Band Layer Reinforcing
- .8 Detail placement of reinforcing where special conditions occur.

#### **1.05 DELIVERY, STORAGE & HANDLING**

- .1 Store materials on site in a manner to prevent damage thereto. Protect from weather. Comply with CSA A23.1, Clause 9.
- .2 Protect work of this Section from damage. Protect other work from damage resulting from this work. Replace damaged work which cannot be satisfactorily repaired.
- .3 Handle, transport and install epoxy coated reinforcing steel bars carefully to avoid damage thereto. Conform to OPSS 1442, Clause 1442.07.03.

### **PART 2 Products**

#### **2.01 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by Consultant.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Deformed steel wire for concrete reinforcement: to CSA G30.14.
- .4 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.
- .5 Epoxy coating of non-prestressed reinforcement: to ASTM A 775/A 775M.
- .6 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1. To be adequate for strength and support of reinforcing construction required. Use chairs with plastic coated feet where slab and beam soffits will be exposed.
- .7 Mechanical splices: subject to approval of Consultant.
- .8 Plain round bars: to CAN/CSA-G40.21.

#### **2.02 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ANSI/ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, unless indicated otherwise.

- .2 Obtain Consultant's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

**2.03 Source Quality Control**

- .1 Provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.
- .2 Inform Consultant of proposed source of material to be supplied.

**PART 3 Execution**

**3.01 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

**3.02 Placing Reinforcement**

- .1 Place reinforcement in accordance with reviewed shop drawings and in accordance with CAN/CSA-A23.1. Support with chairs, bolsters, bar supports or spacers in as close spacing as possible to prevent displacement of reinforcement from intended bar position, before and during placing of concrete. Pieces of block, wood, and/or similar items, are not acceptable as chairs and spacers.

|                        |                      |
|------------------------|----------------------|
| Maximum chair spacing: | 10M - 600 mm (24")   |
|                        | 15M - 1,200 mm (48") |
|                        | 20M - 1,600 mm (64") |
|                        | 25M - 1,900 mm (78") |
- .2 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Consultant's review of reinforcing material and placement. Provide minimum 24 hours notice prior to concrete placement for review.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Protect epoxy coated portions of bars with covering during transportation and handling. Repair in accordance with EM-69.
- .6 Lap wire mesh sections at least 150mm (6") and wire tighter securely; discontinue wire mesh at joints.
- .7 Clean reinforcing before placing concrete.
- .8 Ensure welded wire fabric is lifted to centre of slab (or where indicated) during concrete placing.

**3.03 FIELD TOUCH-UP**

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

**3.04 FIELD QUALITY CONTROL**

- .1 Independent inspection and testing company may be appointed and paid for by Owner to conduct mill tests – physical and chemical analysis of reinforcing steel supplied. Refer to Division 1.
- .2 Cooperate with and assist inspection and testing company's personnel during inspection and tests.
- .3 Remove defective materials and complete work which fails tests and replace as directed by Consultant.

**END OF SECTION**

**PART 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 03 10 00 - Concrete Formwork.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 35 05 - Concrete Floor Hardeners.
- .4 Section 03 35 00 - Concrete Finishing.
- .5 Section 05 12 23 - Structural Steel for Buildings.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM C 109/C109M-07, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).
  - .2 ASTM C 260-06, Specification for Air-Entraining Admixtures for Concrete.
  - .3 ASTM C 309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .4 ASTM C 332-07, Specification for Lightweight Aggregates for Insulating Concrete.
  - .5 ASTM C 494/C494M-08, Specification for Chemical Admixtures for Concrete.
  - .6 ASTM C 827-1827M-02, Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
  - .7 ASTM C 939-02, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.
  - .8 ASTM D 412-06a, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
  - .9 ASTM D 624-00 (2007), Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
  - .10 ASTM D 1751-04, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .11 ASTM D 1752-04a, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
  - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .3 .CGSB 81-GP-1M-10M-79, Flooring, Conductive and Spark Resistant.
- .3 Canadian Standards Association (CSA)
  - .1 CAN/CSA-A5-93, Portland Cement.
  - .2 CAN/CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.
  - .3 CAN/CSA-A23.2-09, Methods of Test for Concrete.
  - .4 CAN/CSA-A23.5-M86(R1992), Supplementary Cementing Materials.
  - .5 CAN/CSA A363-M88(R1996), Cementitious Hydraulic Slag.

**1.03 SAMPLES**

- .1 Submit samples in accordance with Division 1.
- .2 At least 4 weeks prior to commencing work, inform Consultant of proposed source of aggregates and provide access for sampling.

**1.04 CERTIFICATES**

- .1 Submit certificates in accordance with Division 1.
- .2 Minimum 4 weeks prior to starting concrete work submit to Consultant manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
  - .1 Portland cement.
  - .2 Blended hydraulic cement.
  - .3 Supplementary cementing materials.
  - .4 Grout.
  - .5 Admixtures.
  - .6 Aggregates.
  - .7 Water.
  - .8 Waterstops.
  - .9 Waterstop joints.
  - .10 Joint filler.
  - .11 Bonding agent
  - .12 Curing compound
  - .13 Column anchor bolts
  - .14 Sealant
  - .15 Specified admixtures
- .3 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
- .4 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.
- .5 Anchor Bolt Setting Diagrams: Submit detailed drawings for anchor bolt setting.
- .6 Records: Keep a written record of concrete pours, showing location, date, cubic yards or metres of concrete including signed trip ticket for each truck, ambient air temperature, and unusual occurrences during placement of each pour. Permit inspection of records by Consultant at any time. At completion of work, submit a summary of such data in 6 copies to Consultant.

**1.05 QUALITY ASSURANCE**

- .1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Division 1 for Consultant's approval for following items:
  - .1 Falsework erection.
  - .2 Hot weather concrete.
  - .3 Cold weather concrete.
  - .4 Curing.
  - .5 Finishes.

- .6 Formwork removal.
- .7 Joints.
- .2 Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Store materials on site in a manner to prevent damage thereto. Protect from weather. Comply with CSA A23.1, Clause 9.
- .2 Protect work of this Section from damage. Protect other work from damage resulting from this work Replace damaged work which cannot be satisfactorily repaired.

#### **1.07 GENERAL**

- .1 Do not place concrete during or before rain. If rain occurs after placing and before initial set of concrete, cover with waterproof material until set. Embedded materials used in parking structural slab for floor drains, pipes and other hardware shall be non-metallic; and a low copper aluminum alloy, as designated in CAN3-B79 or an equally corrosion resistant metal, coated on surfaces in contact with concrete to prevent galvanic corrosion with steel reinforcing or protected against corrosive effects of de-icing chemicals by an effective and durable coating.
- .2 Do not use calcium chloride or other chemical in mix to reduce freezing point of concrete.
- .3 When ready mixed (mixed in transit) concrete is used, complete discharge of concrete within period of 1 hour after mixing water has been added to dry material except when concrete materials are heated, in which case reduce this period to 30 minutes. When concrete is delivered at air temperature below 4 deg C (39 deg F), ensure temperature at work of not less than 16 deg C (61 deg F) or more than 32 deg C (90 deg F).

### **PART 2 Products**

#### **2.01 MATERIALS**

- .1 Execution Portland cement to CAN/CSA-A5-93 Type 10 & Type 20 (MS or MSb).
- .2 Blended hydraulic cement: to CAN/CSA-A5A363-88(R1998).
- .3 Supplementary cementing materials: to CAN/CSA-A23.5.
- .4 Cementitious hydraulic slag: to CAN/CSA-A363.
- .5 Water: to CAN/CSA-A23.1.
- .6 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density fine aggregates to CAN/CSA-A23.1.
- .7 Air entraining admixture: to ASTM C 260.
- .8 Chemical admixtures: to ASTM C 494. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.
  - .1 Admixtures may be added to concrete to provide following specific qualities as required or permitted in this Section shall meet the following criteria:
    - .1 Workability.
    - .2 Entrained air content.



- .3 Controlled rate of handling.
  - .4 Compressive or flexural strength.
- .2 Admixtures shall conform to ASTM C260 and ASTM C494M except they shall not, individually or in combination, increase shrinkage of concrete compared with a reference specimen of same mix but not contained admixture. Where used individually, following water reducing admixtures are acceptable.
- .9 Concrete retarders: to ASTM C 494 water based, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film.
- .10 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
  - .1 Compressive strength: 50 MPa (7,250 psi) at 28 days.
  - .2 Consistency:
    - .1 Fluid: to ASTM C 827. Time of efflux through flow cone ( ASTM C 939), under 30s.
    - .2 Flowable: to ASTM C 827. Flow table, 5 drops in 3s, (ASTM C 109, applicable portion) 125 to 145%.
    - .3 Plastic: to ASTM C 827. Flow table, 5 drops in 3 s, (ASTM C 109, applicable portions) 100 to 125 %.
    - .4 Dry pack to manufacturer's requirements.
- .11 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 35 MPa at 28 days.
- .12 Curing compound: to CAN/CSA-A23.1 and at ASTM C309.
- .13 Ribbed waterstops: extruded PVC of sizes indicated with shop welded corner and intersecting pieces.
- .14 Labyrinth waterstops: extruded PVC of sizes indicated with prewelded corner and intersecting pieces.
- .15 Premoulded joint fillers:
  - .1 Bituminous impregnated fiber board: to ASTM D 1751.
  - .2 Sponge rubber: to ASTM D 1752, Type I, flexible grade.
  - .3 Self-expanding standard cork: to ASTM D 1752, Type III.
- .16 Weep hole tubes: plastic.
- .17 Dampproofing below slab on grade:
  - .1 Place as per Architectural specifications (Division 7).
    - .1 Where not noted in Division 7, provide:
      - .1 Reinforced: two 10 mil thick polyethylene films bonded each side of asphalt treated creped kraft paper, reinforced with 12 mm x 12 mm (½" x ½") fibreglass scrim.
      - .2 Membrane adhesive: as recommended by membrane manufacturer.
      - .3 Lap damp proof membrane minimum 150 mm (6") at joints and seal. Carry up walls to top of slabs.
      - .4 Seal punctures in damp proof membrane before placing concrete. Use patching material at least 150 mm (6") larger than puncture and seal.

- .18 Dampproofing on Foundation Walls:
  - .1 Place as per Architectural specifications (Division 7).
- .19 Bonding agent: Supply ST-433 by Sternson, Sika-Dur Hi-Mod by Sika Chemical or Bondlok by W.R. Meadows of Canada Ltd., SBR Latex by Euclid Chemical or Acrylic Adhesive by C C Chemicals Limited.
- .20 Water: Conforming to CSA A23.1 (09).
- .21 Anchor Bolts: To meet specified requirements of ASTM A307, Section 1.3. Provide suitable nuts and washers to meet specified requirements of ASTM A563M, Table 11 (Hot dip galvanized to CSA G164-M).
- .22 Wet Curing: Water conforming to CSA A23.1, Clause 4, clear and entirely free from any elements which might cause staining of concrete, and minimum 4 mil thick polyethylene film as specified herein.

## **2.02 MIXES**

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, to give the quality for all concrete as indicated on drawings and plans.
- .2 Ready-mixed concrete and concrete proportions shall be in accordance with CSA A23.1, Clause 12 and as follows:
- .3 Minimum allowable compressive strength shall be 30 MPa (4350 psi) at 28 Days of age, unless otherwise noted or shown.
- .4 If blended normal Portland cement/cementitious hydraulic slag is used except for floor mixes, slag content shall not be more than 25% of total mass of cement. Total volume of cement in concrete floor mixes shall be 100% Normal Portland Cement.
- .5 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CAN/CSA-A23.1-09.
- .6 Mix designs submitted to outline anticipated 24 hour concrete strength for each type of concrete produced.
- .7 Use of calcium chloride not permitted.
- .8 Do not change concrete mix without prior approval of Consultant. Should change in material source be proposed, new mix design to be approved by Consultant.
- .9 Where air entrainment is required, air content should have a range which is dependant on the exposure class and the aggregate size, based on the requirements outlined in CSA A23.1(09).

## **PART 3 Execution**

### **3.01 PREPARATION**

- .1 Obtain Consultant's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
  - .1 Obtain Consultant's review of reinforcing placement before placing concrete. Provide 24 hrs. notice prior to placing of concrete. In slab construction, ensure that all bottom steel and at least 66% of top steel is in place and inspected before commencing concrete placement. For walls and columns leave one side of form open for review of reinforcing. Close furing only after Consultant has reviewed bar placement.

- .2 Pumping of concrete is permitted only after approval of equipment and mix in writing by Consultant.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .7 Do not place load upon new concrete until authorized by Consultant.
- .8 Confirm surfaces on which concrete is to be placed are free of frost, water and debris before placing concrete.

### 3.02 CONSTRUCTION JOINTS

- .1 Where construction joints other than those indicated on Drawings are required, locate in consultation with Consultant.
- .2 Unless agreed otherwise for specific locations by Consultant, provide shear keys in all construction joints. Normally, form keys from 38 x 89 (2" x 4") material. Depth of keys shall total approximately 1/4 of the depth of member. In deep members, use 2 or more keys. Face of previously placed concrete to be roughened to minimum amplitude of 6.4mm (1/4") at all construction joints (horizontal/vertical). Joints to be free of all debris/loose materials prior to concrete placement.
- .3 Construction joints shall be straight and plumb unless otherwise agreed for specific conditions.
- .4 Install PVC waterstops in horizontal and vertical construction joints in walls at or below grade, and at other locations where shown. Waterstops shall be continuous throughout length of joint.
  - .1 Install waterstops to provide continuous waterseal. Do not distort or pierce waterstop in such a way as to hamper performance. Do not displace reinforcement when installing. Tie waterstops in place.
  - .2 Use only straight heat sealed butt joints in field. Use factory welded corners and intersections, unless otherwise approved by Consultant.
- .5 Unless otherwise detailed on the Structural Drawings, reinforcement shall be continuous through construction joints.
- .6 Maximum length of pour not to exceed 18 m (60 ft.)

### 3.03 CONTROL JOINTS

- .1 In walls, form grooves for control joints on both faces, as detailed. Unless otherwise noted, cut or stop alternate horizontal reinforcing bars at the joints. Sealant and sealant backing - under Sealant Section in Division 7.
- .2 In slab on grade floors, form or sawcut control joints as detailed. Where 'diamonds' or other isolation joints are shown to be constructed around columns or piers, place after the floor has been concreted and sawcuts have been made.
- .3 Use 10 mm (3/8") thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 10 mm (3/8") of finished slab surface unless indicated otherwise.

### 3.04 EXPANSION JOINTS

- .1 Provide expansion joints where shown and as detailed.
- .2 In exterior walls, or interior walls against soil, install PVC waterstop for full length of joint. Fill joint with pre-moulded plastic foam filler to within 25 mm (1") of wall faces. Sealant and Sealant Backing - under Sealant Section in Division 7.
- .3 Take special care to prevent concrete 'bridging' over expansion joints. Carefully pack around bearing pads with expansion joint material to maintain freedom of movement of joint.
- .4 Expansion joints in floors and walls shall be continuous from one to the other.

### 3.05 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1 (09).
- .2 Sleeves and inserts.
  - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Consultant in writing.
  - .2 Where approved by Consultant in writing, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm (4" x 4") not indicated, must be approved by Consultant.
  - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Consultant before placing of concrete.
  - .4 Check locations and sizes of sleeves and openings shown on drawings.
  - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts.
  - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
  - .2 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
  - .3 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage holes and weep holes:
  - .1 Form weep holes and drainage holes in accordance with Section 03100 - Concrete Formwork. If wood forms are used, remove them after concrete has set.
  - .2 Install weep hole tubes and drains as indicated.
- .5 Dovetail anchor slots:
  - .1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.
  - .2 Install continuous vertical anchor slots at 800 mm (32") o.c. where concrete walls are masonry faced.
- .6 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .7 Finishing.
  - .1 Finish concrete in accordance with CAN/CSA-A23.1 and Section 03362.

- .2 Use procedures acceptable to Consultant or those noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.
- .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
- .8 Installation
  - .1 Preparation for placing concrete:
  - .2 Ensure that foundation excavations are free of frost or water before placing concrete. If a sump is required for pumping water from the excavation, excavate it outside the area of the foundation. Remove any wet or disturbed soil just prior to placing concrete.
  - .3 Before placing concrete, check that all forms are rigid and structurally safe, and that all reinforcing steel, formwork, sleeves, anchor bolts and other items are installed in accordance with the drawings and specifications. Ensure that all trades have checked the security and location of all components required in the concrete by those trades.
  - .4 Ensure that the electrical conduits have been properly set in the mid-height of the slab, beam, or other concrete. Avoid concentrations and crossing of conduit. Any such concentrations which are required shall be approved by the Consultant before concrete is placed. The Contractor shall co-ordinate the placing of reinforcement with the Electrical Subcontractor to ensure that both conduit and reinforcement are properly placed.
  - .5 Immediately prior to placing concrete slabs on granular base, moisten the base material to reduce absorption of moisture from the concrete.

**END OF SECTION**

**PART 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 03 30 00 - Cast-In Place Concrete.

**1.02 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
  - .2 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .2 Canadian Standards Association (CSA)
  - .1 CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.

**1.03 PERFORMANCE REQUIREMENTS**

- .1 Product quality and quality of work in accordance with Division 1.
- .2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.
- .3 Provide mock-ups of Architectural Concrete elements as outlined as well as mock-ups of landscape concrete at planters.

**1.04 PRODUCT DATA**

- .1 Submit product data in accordance with Division 1.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Division 2. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content.
- .3 Include application instructions for concrete floor treatments.

**1.05 ENVIRONMENTAL REQUIREMENTS**

- .1 Temporary lighting:
  - .1 Minimum 1200 W light source, placed 2.5 m (8'-0") above floor surface, for each 40 sq m (430 ft<sup>2</sup>) of floor being treated.
- .2 Electrical power:
  - .1 Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:
  - .1 Make the work area water tight protected against rain and detrimental weather conditions.
- .4 Temperature:
  - .1 Maintain ambient temperature of not less than 10°C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .5 Moisture:

- .1 .1 Ensure concrete substrate is within moisture limits prescribed by finish manufacturer.
- .6 Safety:
  - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation

## **PART 2 Products**

### **2.01 CHEMICAL HARDNERS**

- .1 Type 1 - Sodium silicate.
- .2 Water: potable.

### **2.02 SEALING COMPOUNDS**

- .1 Surface sealer: to CAN/CGSB-25.20, Type 2 - water based, clear.
- .2 Surface sealers may not be manufactured or formulated with aromatic solvents formaldehyde halogenated solvents mercury lead cadmium hexavalent chromium and their compounds.

### **2.03 CURING COMPOUNDS**

- .1 Select low VOC, water-based, organic-solvent free curing compounds.

### **2.04 CONCRETE STAINS**

- .1 Select low VOC, water-based concrete stains.

### **2.05 MIXES**

- .1 Mixing, ratios and application in accordance with manufacturer's instructions.

### **2.06 SEALANTS**

- .1 EUCO QWIKJOINT 200 (The Euclid Chemical Company) or similar equivalent approved.

### **2.07 CARBORUNDUM STRIPS**

- .1 Extruded Aluminum Self Anchoring Anit-Slip Strip: CT-22/34A (K.N. Crowder MFG. Inc.) or similar equivalent approved.
- .2 Epoxy/Sand Mix: Sika Dur 30 epoxy and black silica sand or similar equivalent approved.

## **PART 3 Execution**

### **3.01 Finishing**

- .1 Formed Concrete Surfaces
  - .1 After removal of fins, replace or treat honeycombing or defects in exposed concrete surfaces according to CSA A23.1 for Formed Surfaces. Refer honeycombed areas to the Consultant for designation as structural or non-structural, and repair according to CAN3 Specifications

- .2 Bring the surfaces of all exposed interior and exterior concrete to a smooth rubbed finish not later than 5-6 hours after removal of forms and in accordance with the requirements of CSA A23.1.
- .3 The producing of smooth surfaces by means of cement plaster will not be permitted unless otherwise specified or scheduled.
- .2 Concrete Floors:
  - .1 Leave slabs reasonably level or sloped to drains, ready for finishing.
  - .2 Refer to Item 4.2 for finishing.
- .3 Architecturally Exposed Concrete:
  - .1 Remove fins, ravelings, and loose material, all surface defects over 12 mm (1/2 inch) in diameter or more than 12 mm (1/2 inch) deep, shall be repaired. Holes left by removal of form ties shall be reamed and filled. Defects more than 12 mm (1/2 inch) in diameter shall be cut back to sound concrete, but in all cases at least 25 mm (1 inch) deep.
  - .2 The surfaces designated as Architectural Concrete, as per Architect, shall be given a grout-cleaned finish as described, as approved by the Consultants and after all required curing, cleaning, and repairs have been completed. Surfaces to be grout-cleaned shall be moist cured for the required period of time before application of the grout-cleaned finish. Grout-cleaning shall be delayed until near the end of construction on all surfaces not to be painted in order to achieve uniformity of appearance and reduce the chance of discoloring caused by subsequent construction operations. The temperature of the air adjacent to the surface shall be not less than 50C (400F) for 24 hours prior to and 72 hours following the application of the finish. The finish for any area shall be completed in the same day, and the limits of a finished area shall be made at natural breaks in the finished surface. The surface to receive grout-cleaned finish shall be thoroughly wetted to prevent absorption of water from the grout but shall have no free water present. The surface shall then be coated with grout. The grout shall be applied as soon as the surface of the concrete approaches surface dryness and shall be vigorously and thoroughly rubbed over the area with clean burlap pads, cork floats or stones, so as to fill all voids. The grout shall be composed of one part portland cement as used on the project, to two parts by volume of well-graded sand passing a 600-µm (No. 30) sieve mixed with water to the consistency of thick paint. White portland cement shall be used for all or part of the cement as approved by the Consultants to give the desired finish color. The applied coating shall be uniform, completely filling all pits, air bubbles, and surface voids. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, burlap pad, or other means. Then, after the surface whitens from drying (about 30 minutes at normal temperature) rub vigorously with clean burlap pads. Immediately after rubbing is completed, the finished surface shall be continuously moist cured for 72 hours. Burlap pads used for this operation shall be burlap stretched tightly around a board to prevent dishing the mortar in the voids.
  - .3 Surfaces listed as Architectural Concrete shall have surface defects repaired as follows: defective areas, voids, and honeycombs smaller than 10 000 square mm (16 square inches) in area and less than 13 mm (1/2 inch) deep and bug holes exceeding 13 mm (1/2 inch) in diameter shall be chipped and filled with dry-packed mortar. Holes left by removal of tie rods shall be reamed and filled with dry-packed mortar. Defective and unsound concrete areas larger than described shall be rejected or made good to the Consultants satisfaction.



- .4 Contractor to provide mock-ups of Architectural Concrete Elements, as per Division 01. Mock-up to be removed provided requirements of Division 01 have been met and mock-up does not form part of structure of building.
  - .1 Concrete column designated as Architectural Concrete to have same diameter and reinforcement as specified column and to be a minimum of 1800 mm high. Contractor to supply engineered foundation or other required support for mock-up.
  - .2 Concrete wall designated as Architectural Concrete to have mock-up in location determined by Architect.
- .5 Finish for exposed concrete shall match the approved prototype sample wall and is to have uniform colour and texture throughout.
- .4 Finish types for walls, columns, and other vertical elements are as follows:

Type 1 – Concrete Exposed with Surface Coatings: Sack rubbed finish, interior - all interior surfaces and any and all exposed rectangular concrete columns noted to be painted or to have applied coatings as noted on finish schedule.

Type 2 – Concrete Exposed in the Finished Work: Use high density overlay formwork or patterned formwork as detailed on the drawings. Repair imperfections only after consultation with the Architect. For exposed walls in stairwells with patterned finish, refer to architectural drawings and specifications for formwork patterns and tie layouts.

Type 3 – Concrete Not Exposed in the Finished Work: As formed finish. Fill all surface imperfections (voids & honeycombing) as directed on site by Consultant. Patching material to be approved by Consultant prior to application.
- .5 Concrete not exposed in the finished work e.g. exterior concrete below grade, concealed ceiling spaces and wall surfaces to be finished to CAN/CSA-A23.1-M00.
- .6 Refer to CSA A23.1, Clause 24 for descriptions of above finishes.

## **PART 4 Execution**

### **4.01 EXAMINATION**

- .1 Verify that all surfaces are ready to receive work and elevations are as indicated on drawings.

### **4.02 WORKMANSHIP**

- .1 Steel trowel concrete slabs to be left exposed or to receive resilient flooring or carpeting. For concrete containing air entrainment float/trowel slab in accordance with A23.1 (09).
- .2 Other concrete slabs to be screeded off to true lines and levels shown and left ready to receive finish. Depress slabs where required.
- .3 Where floor drains occur, floors to be level around walls and have a minimum 6mm in 1m (1/4" in 30") uniform pitch to drains, unless indicated otherwise.
- .4 Co-ordinate with equipment suppliers regarding additional requirements for tolerances on floor level finishes etc.
- .5 Plain Floor Finish (unexposed)
  - .1 Roll or tamp concrete to force coarse aggregate into concrete mix, then screed.
  - .2 Float surface with wood or metal float or with power finishing machine and bring surface to true elevation.

- .3 Steel trowel to smooth and even surface. For concrete containing air entrainment float/trowel slab in accordance with A23.1 (09).
- .4 Unless otherwise noted, follow with second steel trowelling to produce smooth burnished surface to within 6mm tolerance when measured in any direction using 3 m (10') straight edge. Do not over trowel.
  - .1 For floor areas to receive ceramic tile, produce fine broom finished surface to within 3 mm (0.12") tolerance when measured in any direction using 3,000 mm (10') straight edge and not more than 1.5mm (0.06") in 305mm (12") when measured from high points.
  - .2 For floor areas to receive ceramic tiles that are 300 x 600 mm (12"x24") in size, produce fine broom finished surface to within 1.5 mm (0.06") in 600 mm (24") tolerance when measured in any direction from the high points in the surface.
  - .3 For floor areas to receive epoxy terrazzo flooring or resilient floor finishes, produce fine broom finished surface to within 3 mm (0.12") tolerance when measured in any direction using 3,000 mm (10') straight edge and not more than 1.5mm (0.06") in 305mm (12") when measured from high points.
  - .4 For any floor areas that are to support working equipment/other floor level sensitive elements, floor flatness to be in accordance with architectural requirements and equipment manufacturer's data where these requirements exceed the tolerances outlined in this specification/construction documents. All equipment requirements/room data sheets to be coordinated prior to placement of concrete.
- .5 Sprinkling of dry cement or dry cement and sand mixture over concrete surfaces is not acceptable.
- .6 Apply curing compound in accordance with manufacturer's instructions. Do not use curing compound when slab is to receive bonded finish. Damp curing or other approved method shall then be employed.
- .7 After curing and when concrete is dry, seal control joints and joints at junction with vertical surfaces with sealing compound.
- .6 Floor Finish (exposed)
  - .1 Finish concrete floors as per Paragraph 4.2, Clauses .1 to .5, and apply floor hardener, non-metallic aggregate at a rate of 5 kg/m<sup>2</sup> (1lb / ft<sup>2</sup>) to manufacturer's instructions.
  - .2 Apply approved curing/sealing compound to manufacturer's instructions.
  - .3 After curing/sealing and when concrete is dry, seal control joints and joints at junction with vertical surfaces with sealing compound.
  - .4 Clean surfaces and apply second coat curing/sealing compound before handing building over to Owner.
- .7 Saw cut Joints (Slabs-on-Grade):
  - .1 Saw cut control joints and construction joints in slab where shown, in straight lines.
  - .2 Perform saw cutting 12 to 24 hours after concrete has been placed, depending on when saw can be run over concrete surface without leaving tread marks, when concrete can be sawn without dislodging aggregate and before uncontrolled shrinkage has occurred. Do not postpone sawing operations beyond these time limitations.
  - .3 Spray water on saw blade at all times during sawing. Grind edges of sawcuts to eliminate burrs; do not grind to bevel or chamfer joint edges.

- .4 After sawing and grinding, clean joints with a jet of water, and blowout with compressed air. Broom clean residue caused by sawing operation. Seal with joint filler.
- .5 When cleaned joints are dry and prior to traffic being allowed over the area, install temporary polyethylene rope in such joints to prevent contamination of same.

#### 4.03 APPLICATION

- .1 Curing/Sealing:
  - .1 Liquid Compound Curing/Sealing: Apply compound after saw cutting operations have been completed to all horizontal concrete surfaces, at a rate recommended by compound manufacturer. Clean concrete floor of laitance, tire marks, oil, grease, etc. to the satisfaction of the Consultant prior to applying sealing compound.
  - .2 Water Curing: Water cure slabs where so designated. Do not use curing/sealing compound. Water down entire area and cover with polyethylene sheets for a minimum of 7 Days. Sheet coverage to include exposed edges. Provide suitable weights to prevent blow-off or displacement of sheets. Remove cover after minimum 7 consecutive Days. Allow to air dry until concrete has developed design strength.
- .2 Anchor Bolt Protection:
  - .1 Adequately protect unburied portion of anchor bolts set in concrete, including nuts and washers from rusting, corrosion and damage by a heavy coating of specified coating material; wrap in a manner to exclude moisture.
  - .2 Clean surfaces to be protected to bare steel followed by the specified protection system.
- .3 Grouting: Grout column base plates and miscellaneous work to be grouted in accordance with grout manufacturer's printed directions. Form around bases, place grout in a manner, which will ensure positive bearing of the full area of the steel plate on top of the supporting surface. Thoroughly compact, leaving no voids.
- .4 Sealants:
  - .1 Sealant At V-Joints: Prime, prepare substrate and apply sealant full joint depth in accordance with manufacturer's printed directions. Tool to a smooth semi-concave finish. Exclude joints in surfaces to receive waterproofing treatment.
  - .2 Sealant at Saw cut Joints/Reglets/Isolation Joints: Do not fill saw cut joints and isolation joints sooner than 30 days after concrete pours. Comply with curing and saw cutting requirements as specified herein. Execute joint sealing as specified herein during cool, dry ambient conditions when slab is in a contracted state to minimize future joint separation at sealant filled joints.
    - .1 Application:
      - .1 Remove temporary polyethylene rope from joints or reglets. Clean joints and blow clean with compressed air.
      - .2 Fill sawn joints in concrete slabs full depth with saw cut joint sealant in accordance with manufacturer's printed directions.
      - .3 Caulk over isolation joints and reglets with specified sealant per manufacturer's instructions.
      - .4 Comply with application and substrate temperature requirements. Mask floor to edge of joints and fill joint with sealant. After initial set, prime sealant surface and refill joints with sealant as required to produce slightly convex joint surface.

**END OF SECTION**

**PART 1 General**

**1.01 SECTION INCLUDES**

- .1 Materials and installation for concrete floor hardeners, slip resistant coatings, and sheet curing materials.

**1.02 RELATED SECTIONS**

- .1 Section 03 10 00 - Concrete Formwork.
- .2 Section 03 35 00 – Concrete Finishings

**1.03 REFERENCES**

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

**1.04 SUBMITTALS**

- .1 Submit product data in accordance with Division 1.
- .2 Include application instructions for concrete hardener curing compound and slip resistant coating.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Division 2.
  - .1 WHMIS MSDS acceptable to Human Resources Development Canada-Labour and Health Canada for concrete floor hardeners.
  - .2 Indicate VOC content.

**PART 2 Products**

**2.01 FLOOR HARDENER**

- .1 Non-metallic hardener: premixed, dry shake surface hardener, abrasion resistant.

**2.02 Slip Resistant Abrasive Aggregate**

- .1 Emery aggregate: crushed emery, minimum 50 % aluminum oxide.
- .2 Homogeneous aluminum oxide, minimum 95%.
- .3 Ferric oxide, minimum 25%.
- .4 Silicon carbide.

**PART 3 Execution**

**3.01 EXAMINATION**

- .1 Verify that slab surfaces are ready to receive Work.

**3.02 HARDENING**

- .1 Apply floor hardener aggregate at rate of 5 kg/m<sup>2</sup> (1lb per sq. ft.) in accordance with manufacturer's written instructions.
- .2 Apply slip resistant coating on floor surfaces as scheduled. Apply in strict accordance with manufacturer's written instructions.

**3.03 PROTECTION**

- .1 Protect finished installation until floor treatment has completely cured.

**END OF SECTION**

**Part 1 General**

**1.01 REFERENCES**

- .1 Canada Green Building Council (CaGBC).
  - .1 LEED Canada Reference Guide for Green Building and Construction. 2009.
- .2 CSA Group.
  - .1 CSA-A165 Series-14. CSA Standards on concrete masonry units.
  - .2 CAN/CSA-A371-14. Masonry construction for buildings.
  - .3 CSA-S304-14. Design of masonry structures.

**1.02 ADMINISTRATIVE REQUIREMENTS**

- .1 Conduct pre-installation meeting one week prior to commencing on-site installations to:
  - .1 Verify project requirements, including mock-up requirements.
  - .2 Verify substrate conditions.
  - .3 Co-ordinate products, installation methods and techniques.
  - .4 Sequence work of related sections.
  - .5 Co-ordinate with other building subtrades.
  - .6 Review manufacturer's installation instructions.
  - .7 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.

**1.03 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, catalogue pages, specifications and product datasheets. Include product characteristics, performance criteria, limitations and colours.
- .3 Submit product data sheet for masonry cleaning compound.
- .4 Provide 2 copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) for all products.
- .5 Provide samples as follows:
  - .1 6 of each type of concrete masonry unit specified, including special shapes.
  - .2 2 cured samples of mortar and grout.
  - .3 2 of each type of masonry accessory specified.
  - .4 2 of each type of masonry anchorage, reinforcement and connector proposed for use.
  - .5 Submit samples used for testing.
- .6 Provide Sustainable Design Submittals. LEED Submittals: in accordance with Section 01 35 21 - LEED Requirements.
- .7 Provide manufacturer's product certificates certifying materials comply with specified requirements. Provide manufacturer's installation instructions, including storage, handling, safety and cleaning.
- .8 Provide certified test reports to certify compliance of masonry units and mortar ingredients with specified performance characteristics and physical properties.

- .9 Provide data for masonry units, in addition to requirements set out in referenced CSA and ASTM Standards, indicating initial rates of absorption.

#### 1.04 QUALITY ASSURANCE

- .1 Mason Qualifications: company or person specializing in masonry installations with 5 years documented experience with masonry work similar to this project. Masons employed on this project must demonstrate ability to reproduce mock-up standards.
- .2 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
  - .1 Construct mock-up panel of interior masonry wall construction 1200 x 1800 mm showing use of reinforcement, ties, jointing, coursing, mortar and workmanship.
  - .2 Mock-up will be used to judge workmanship, preparation, and material application.
  - .3 Construct mock-up where directed by Consultant. Allow 24 hours for inspection of mock-up before proceeding with work.
  - .4 When accepted, mock-up will demonstrate minimum standard for this work. When approved, Mock-up may remain as part of finished work.
  - .5 Start work only upon receipt of written approval of mock-up.
- .3 Concrete masonry units will be sampled and tested by independent testing agency appointed and paid by Consultant in accordance with CSA-S304.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Keep materials dry until use. Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

#### 1.06 WASTE MANAGEMENT

- .1 Remove for reuse and return all pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management And Disposal.
- .2 Separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal and 01 35 21 - LEED Requirements.
- .3 Divert unused or damaged masonry units from landfill as specified in Section 01 74 21 - Construction / Demolition Waste Management and Disposal. Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

#### 1.07 SITE CONDITIONS

- .1 Conduct all masonry work when temperatures are above 4 degrees C.
- .2 Weather Requirements: to CAN/CSA-A371.
- .3 Cold weather requirements: to CAN/CSA-A371 with following requirements.
  - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
  - .2 Maintain ambient temperature at areas to conduct masonry work between 5 degrees C and 50 degrees C and protect site from windchill.
  - .3 Maintain temperature of masonry above 0 degrees C for minimum of 28 days after mortar is installed.



- .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.
- .4 Hot weather requirements:
  - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
  - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
  - .3 Spray mortar surface at intervals and keep moist for maximum of three days after installation.

## **Part 2 Products**

### **2.01 MATERIALS**

- .1 Masonry materials are specified in related Sections.

## **Part 3 Execution**

### **3.01 MANUFACTURER'S INSTRUCTIONS**

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

### **3.02 EXAMINATION**

- .1 Examine conditions, substrates and work to receive work of this Section. Co-ordinate with Section 01 71 00 - Examination and Preparation.
- .2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.
  - .1 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval Consultant.
- .3 Verify that:
  - .1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete block.
  - .2 Field conditions are acceptable and are ready to receive work.
  - .3 Built-in items are in proper location, and ready for roughing into masonry work.
  - .4 Commencing installation means acceptance of existing substrates.

### **3.03 PREPARATION**

- .1 Prepare surface in accordance with manufacturer's written recommendations.
- .2 Establish and protect lines, levels, and coursing.
- .3 Protect adjacent finished materials from damage and disfiguration due to masonry work.

**3.04 INSTALLATION**

- .1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CAN/CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

**3.05 CONSTRUCTION**

- .1 Remove and cull out masonry units with chips, cracks, broken corners, excessive colour and texture variation or otherwise damaged units in accordance with CSA-A165 and replace with undamaged units.
- .2 Jointing:
  - .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.
  - .2 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.
- .3 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges. Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.
- .4 Building-In:
  - .1 Build in items required to be built into masonry.
  - .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
  - .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar. Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.
  - .4 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.
- .5 Support of loads: Install grout or concrete in core of masonry units as specified in Section 04 05 12 - Masonry Mortar and Grout.
  - .1 Install loose steel lintels. Centre over opening width.
- .6 Movement Joints: Build-in continuous movement joints as indicated. Keep joints free of mortar.
  - .1 Leave 3 mm space below shelf angles.
  - .2 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.
  - .3 Built masonry to tie in with stabilizers, with provision for vertical movement.
- .7 Construct continuous control joints as indicated.
- .8 Interface with other work: Openings in walls to be approved by Consultant. Make good existing work. Use materials to match existing.

**3.06 SITE TOLERANCES**

- .1 Tolerances in notes to CAN/CSA-A371 apply.

**3.07 CLEANING**

- .1 Continuously clean site in accordance with Section 01 74 11 - Cleaning.
- .2 Conduct cleaning of concrete unit masonry surfaces as specified in Section 04 22 00 - Concrete Unit Masonry.
- .3 Perform final cleaning after installation to remove construction and accumulated environmental dirt. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**3.08 PROTECTION**

- .1 Temporary Bracing:
  - .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
  - .2 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
- .2 Keep masonry dry using waterproof, non staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.
- .3 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .3 Section 04 22 00 - Concrete Unit Masonry.

**1.02 REFERENCES**

- .1 CSA Group.
  - .1 CAN/CSA-A179-14. Mortar and grout for unit masonry.
  - .2 CAN/CSA-A371-14. Masonry construction for buildings.

**1.03 SUBMITTALS**

- .1 Provide submittals for masonry components as specified in Section 04 05 00 - Common Work Results for Masonry.
- .2 Provide Quality Assurance submittals including Test reports and Manufacturer's certificates as specified in Section 04 05 00 - Common Work Results for Masonry.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Mortar: to CAN/CSA-A179.
- .3 Aggregate: use aggregate passing 1.18 mm sieve where 6.0 mm thick joints are indicated.
- .4 Concrete: as specified in Section 03 30 00 - Cast-in-Place Concrete. 20.0 MPa minimum.

**2.02 MORTAR TYPES**

- .1 Mortar for interior concrete block masonry above grade: to CAN/CSA-A179. Table 3.
  - .1 Loadbearing: Type S based on proportion specifications.
  - .2 Non-loadbearing: Type N based on proportion specifications.

**2.03 GROUT**

- .1 Non-shrink structural grout: to CAN/CSA-A179.  $f'_c = 20$  MPa.
- .2 Grout: Minimum compressive strength of 12.5 MPa at 28 days. Maximum aggregate size and grout slump to CAN/CSA-A179.
  - .1 Lintels and Bond Beams: grout mix 12.5 MPa strength at 28 days. 200 - 250 mm slump. Mixed in accordance with CAN/CSA-A179. Fine grout, Table 5.

**Part 3 Execution**

**3.01 GENERAL**

- .1 Do masonry mortar and grout work in accordance with CAN/CSA-A179 except where specified otherwise.

**3.02 MIXING**

- .1 Pre-hydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than one hour nor more than two hours then remix with sufficient water to produce mortar of proper consistency for pointing.

**3.03 GROUT**

- .1 Mix grout to semi-fluid consistency.
- .2 Place grout in accordance with manufacturer's instructions.
- .3 Install building paper below voids to be filled with concrete or grout. Keep paper 25 mm back from faces of units.
- .4 Ensure vertical cells are clear of mortar prior to grouting. Grout cells in accordance with CAN/CSA-A371. Install grout to requirements of CAN/CSA-A179.
- .5 Work grout into masonry cores and cavities to eliminate voids.
- .6 Do not install grout in lifts greater than 400 mm, without consolidating grout by rodding.
- .7 Do not displace reinforcement while placing grout.

**3.04 SCHEDULE**

- .1 Grout following masonry components:
  - .1 Base plates.
  - .2 Structural Components.
  - .3 Masonry block infill panels.
  - .4 Masonry walls enclosing Room T16: Nuclear Storage Room.
  - .5 Use grout to CAN/CSA-A179 where grout is used in lieu of solid units.
- .2 Fill following masonry components with Concrete.
  - .1 Masonry lintels and bond beams.
  - .2 Use 20 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 04 05 12 - Masonry Mortar and Grout.
- .3 Section 04 22 00 - Concrete Unit Masonry.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International Inc (ASTM).
  - .1 ASTM A153/A153M-16. Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .2 ASTM A951/A951M-16. Standard Specification for Steel Wire for Masonry Joint Reinforcement.
  - .3 ASTM A666-15. Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- .2 CSA Group.
  - .1 CSA-A23.1-14/A23.2-14. Concrete materials and methods of concrete construction / Test methods and standard practices for concrete.
  - .2 CAN/CSA-A179-14. Mortar and grout for unit masonry.
  - .3 CAN/CSA-A370-14. Connectors for masonry.
  - .4 CAN/CSA-A371-14. Masonry construction for buildings.
  - .5 CSA-G30.18-09 (R2014). Carbon steel bars for concrete reinforcement.
  - .6 CSA-S304-14. Design of masonry structures.
  - .7 CSA-W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Manual of Practice, Reinforcing Steel Institute of Canada.

**1.03 SUBMITTALS**

- .1 Provide submittals for masonry components as specified in Section 04 05 00 - Common Work Results for Masonry.
- .2 Provide Quality Assurance submittals including Test reports and Manufacturer's certificates as specified in Section 04 05 00 - Common Work Results for Masonry.
- .3 Submit Shop drawings as specified in Section 04 05 00 - Common Work Results for Masonry.

**1.04 FIELD MEASUREMENTS**

- .1 Make field measurements necessary to ensure proper fit of members.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Bar reinforcement: deformed steel reinforcing bars to CAN/CSA-A371 and CSA-G30.18. Grade 400. Mill finish.

- .2 Wire reinforcement: to ASTM A951/A951M. Extra heavy duty, truss type reinforcement. 2 parallel side rods welded to a continuous diagonally shaped cross rod forming a truss design with alternating welds not exceeding 200 mm OC. overall. Provide prefabricated T shape sections for intersecting walls and prefabricated corner sections. For use in single wythe walls. Design continuous truss type reinforcement to be embedded in horizontal mortar joints of masonry walls. Width to match thickness of masonry block. Hot dip galvanized coating to ASTM A153, Class B2, 457 grams per square meter.
  - .1 Extra Heavy Duty rated. 3/16 diameter side rods and 3/16 diameter cross rods.
- .3 Connectors including wall ties, anchors and dowels to CAN/CSA-A370 and CSA-S304.
- .4 Corrosion protection: Hot dip galvanized to CSA-S304 and CAN/CSA-A370.
- .5 Expansion Anchors: stainless steel torque controlled expansion anchors Grade 304 stainless steel conforming to ASTM A666.

## **2.02 FABRICATION**

- .1 Fabricate reinforcing in accordance with CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Fabricate connectors in accordance with CAN/CSA-A370.
- .3 Obtain Consultant's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Upon approval of Consultant, weld reinforcement in accordance with CSA-W186.
- .5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

## **2.03 SOURCE QUALITY CONTROL**

- .1 Upon request, provide Consultant with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.
- .2 Upon request inform Consultant of proposed source of material to be supplied.

## **Part 3 Execution**

### **3.01 MANUFACTURER'S INSTRUCTIONS**

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

### **3.02 GENERAL**

- .1 Install masonry connectors and reinforcement in accordance with CAN/CSA-A370, CAN/CSA-A371, CSA-A23.1 and CSA-S304 unless indicated otherwise.
- .2 Prior to placing concrete, mortar, grout, obtain Departmental Representative's approval of placement of reinforcement and connectors.
- .3 Install additional reinforcement to masonry as indicated.
- .4 Coordinate installation of anchors with architectural masonry work.

### **3.04 REINFORCED LINTELS AND BOND BEAMS**

- .1 Reinforce masonry beams, masonry lintels and bond beams as indicated.

- .2 Place and grout reinforcement in accordance with CSA-S304, CAN/CSA-A371, and CAN/CSA-A179.
- .3 Support and position reinforcing bars in accordance with CAN/CSA-A371.

**3.05 GROUTING**

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

**3.06 ANCHORS**

- .1 Install anchors as indicated. Install expansion anchors as per manufacturer's instruction.
- .2 Install screws in holes drilled with matched tolerance carbide-tipped drill bits. Install in accordance with manufacturer's instructions.

**3.07 LATERAL SUPPORT AND ANCHORAGE**

- .1 Install lateral support and anchorage in accordance with CSA-S304 and as indicated.

**3.08 MOVEMENT JOINTS**

- .1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

**3.09 FIELD BENDING**

- .1 Do not field bend reinforcement and connectors except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars and connectors which develop cracks or splits.

**3.010 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

**3.011 CLEANING**

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

**END OF SECTION**



**Part 1 General**

**1.01 RELATED REQUIREMENTS**

- .1 Section 04 05 00 - Common Work Results for Masonry.
- .2 Section 04 05 12 - Masonry Mortar and Grout.
- .3 Section 04 05 19 - Masonry Anchorage and Reinforcing.

**1.02 REFERENCES**

- .1 CSA Group.
  - .1 CSA-A165 SERIES-14. CSA Standards on concrete masonry units. (Consists of A165.1, A165.2 and A165.3).
  - .2 CAN/CSA-A179-14. Mortar and grout for unit masonry
  - .3 CAN/CSA-A371-14. Masonry construction for buildings.

**1.03 SUBMITTALS**

- .1 Provide submittals for masonry components as specified in Section 04 05 00 - Common Work Results for Masonry.
- .2 Provide Quality Assurance submittals including Test reports and Manufacturer's certificates as specified in Section 04 05 00 - Common Work Results for Masonry.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Autoclaved standard concrete block units Type II: to CSA-A165 Series (CSA-A165.1).
  - .1 Classification: H/15/D/M.
  - .2 Sizes: CCMPA Metric Modular. Nominal: 200 wide x 200 high x 400 mm long.
  - .3 Provide 150 mm and 200 mm wide block units for wall thicknesses as indicated in the drawings.
  - .4 Special shapes: provide square and bull-nosed units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.
  - .5 Texture and colour: uniform texture and colour.

**2.02 REINFORCEMENT AND CONNECTORS**

- .1 Bar reinforcement, horizontal joint reinforcement and connectors: as specified in Section 04 05 19 - Masonry Anchorage and Reinforcing.

**2.03 MORTAR AND GROUT MIXES**

- .1 Mortar and Gout: as specified in Section 04 05 12 - Masonry Mortar and Grout.

**2.04 CLEANING COMPOUNDS**

- .1 Compounds to be compatible with concrete masonry units and substrate and acceptable to masonry manufacturer for use on products.
- .2 Low VOC product. non acidic compound specifically designated for cleaning concrete masonry surfaces. Dissolves excess mortar, dirt and other common job site soiling. Non

fuming, containing no hydrochloric or other inorganic acids. Safe for use on and around metal surfaces, indoors and out.

## **2.05 TOLERANCES**

- .1 Tolerances for standard concrete unit masonry tolerances in accordance with CSA-A165.1, supplemented as follows:
  - .1 Maximum variation between units within specific job lot not to exceed 2 mm.
  - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.
  - .3 Out of square tolerance not to exceed 2 mm.
  - .4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 2 mm.

## **Part 3 Execution**

### **3.01 EXAMINATION AND PROTECTION**

- .1 Inspect site and prepare for Masonry work as specified in Section 04 05 00 - Common Work Results for Masonry.

### **3.02 INSTALLATION**

- .1 Concrete block units:
  - .1 Bond: running.
  - .2 Coursing height: 200 mm for one block and one joint.
  - .3 Jointing: concave where exposed or where paint or other finish coating is specified.
- .2 Bond Beams: provide bond beams under all structural slabs, at top of walls and below openings. Construct in accordance with CAN/CSA-A371 and as detailed on Drawings. Construct with regular concrete block unit with upper half of web cut away to facilitate horizontal reinforcement. Install layer of building paper below blocks to retain grout until set. Fill core with grout.
- .3 Lintels: Install reinforced concrete block lintels above openings in masonry where steel or reinforced concrete lintels are not indicated. Minimum end bearing: 200 mm. Fill core with grout and install horizontal reinforcement as indicated.

### **3.03 REINFORCEMENT AND CONNECTORS**

- .1 Install reinforcing and connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .2 Install in accordance with manufacturer's written instructions.
- .3 Install reinforcement in accordance with CAN/CSA-A371.

### **3.04 MORTAR PLACEMENT**

- .1 Prepare mortar to manufacturer's instructions.
- .2 Install mortar to requirements of CAN/CSA-A179.
- .3 Remove excess mortar from grout spaces.

### **3.05 CONSTRUCTION**

- .1 Construct concrete block unit masonry to CAN/CSA-A371.

- .2 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.
- .3 Ensure compacted head joints. Use full or face-shell joint as indicated.
- .4 Tamp units firmly into place.
- .5 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.
- .6 Tool exposed joints concave. Strike concealed joints flush.
- .7 After mortar has achieved initial set up, tool joints.
- .8 Do not interrupt bond below or above openings.

**3.06 REPAIR/RESTORATION**

- .1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

**3.07 CLEANING AND PROTECTION**

- .1 Clean and protect completed masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.
- .2 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
- .3 Apply masonry cleaning compounds in accordance with manufacturer's written recommendations and instructions.

**END OF SECTION**

**PART 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 05 31 00 - Steel Decking.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A 36/A36M-05, Specification for Structural Steel.
  - .2 ASTM A 193/A193M-07, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
  - .3 ASTM A 307-76, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
  - .4 ASTM A 325-07a, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  - .5 ASTM A 325M-07a, Specification for High-Strength Bolts for Structural Steel Joints.
  - .6 ASTM A 490M-08a, Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).SUBMITTALS
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
  - .1 CISC/CPMA 1-73b, Quick-Drying, One-Coat Paint for Use on Structural Steel.
  - .2 CISC/CPMA 2-75, Quick-Drying, Primer for use on Structural Steel.
  - .3 CISC Code of Standard Practice (2009)
- .4 Canadian Standards Association (CSA International)
  - .1 CAN/CSA G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-S16-01(05), Limit States Design of Steel Structures.
  - .4 CAN/CSA-S136-07, Cold Formed Steel Structural Members.
  - .5 CSA-S136.1-07, Commentary on CSA Standard S136.
  - .6 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.
  - .7 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
  - .8 CSA W55.3-1965(R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .9 CSA W59-M1989(R2001), Welded Steel Construction (Metal Arc Welding).
- .5 Master Painters Institute
  - .1 MPI-INT 5.1-98, Structural Steel and Metal Fabrications.
  - .2 MPI-EXT 5.1-98, Structural Steel and Metal Fabrications.
- .6 The Society for Protective Coatings (SSPC)
  - .1 SSPC SP-6/NACE No. 3-00, Commercial Blast Cleaning.

**1.03 DESIGN REQUIREMENTS**

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 (with CSA-S136.1) to resist forces, moments, shears and allow for movements indicated
- .2 Shear connections:
  - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
  - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
- .3 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Ontario, Canada for non standard connections.
- .4 Do Welding to CSA W59-M1989 (R2001).

**1.04 SHOP DRAWINGS**

- .1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Division 1.
  - .1 Verify site conditions and dimensions on site before shop drawing preparation. Show all on shop drawings.
  - .2 Shop drawings must be original. Reproduction of Engineer's design drawings is not acceptable.
  - .3 Provide separate fabrication and erection drawings for AESS assemblies, including connection design details and shop details for review by Architect and Engineer.
- .2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:
  - .1 Description of methods.
  - .2 Sequence of erection.
  - .3 Type of equipment used in erection.
  - .4 Temporary bracings.
  - .5 Connections.
- .3 Ensure Fabricator drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the province of Ontario, Canada.

**1.05 SAMPLES**

- .1 Submit samples in accordance with Division 1.
- .2 Prepare sample of typical exposed structural connections in accordance with CISC Code of Standard Practice (Appendix I) Specifications of Architecturally exposed structural steel for approval of Consultant. Samples to be judged upon alignment of surfaces, uniform contact between surfaces, smoothness and uniformity of finished welds. When approved, sample units will serve as a standard for workmanship, appearance and material acceptable for entire project.

**1.06 QUALITY ASSURANCE**

- .1 Submit 5 copies of mill test reports 4 weeks prior to fabrication of structural steel.
  - .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
  - .2 Provide mill test reports certified by metallurgists qualified to practice in province of Ontario, Canada.
  - .3 Provide structural steel Fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

**PART 2 Products**

**2.01 MATERIALS**

- .1 Structural steel: to CAN/CSA-G40.20/G40.21 Grade 350W and CAN/CSA-S136.
- .2 Anchor bolts: to CAN/CSA-G40.20/G40.21, Grade 300W (A307) (unless otherwise noted on drawings). Use stainless steel where bolts exposed to exterior conditions.
- .3 High strength anchor bolts: to ASTM A 325M.
- .4 Bolts, nuts and washers: to ASTM A 325M.
- .5 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .6 Shop paint primer: to CISC/CPMA 2.
- .7 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 0.75 kg/m<sup>2</sup> (0.15 lb/ft<sup>2</sup>).
- .8 HSS Sections: to CAN/CSA-G40.21-M01, Type 350W (Class H).

**2.02 FABRICATION**

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 and CAN/CSA-S136 and in accordance with reviewed shop drawings.
- .2 Continuously seal members by intermittent welds and plastic filler, unless otherwise indicated. Grind smooth.
- .3 Provide holes in top and bottom flanges for attachment of wood nailers, as required.
- .4 Hot dip galvanize after fabrication.
- .5 Architecturally Exposed Steel: Fabricate in accordance with CISC Code of Standard Practice (2009), Appendix I to Category 3 requirements.

**2.03 SHOP PAINTING**

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136, and Division 09.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface according to SSPC-SP-6 and Division 09.
- .3 Apply one coat of primer in shop to steel surfaces to achieve minimum dry film thickness of 0.065 to 0.080 mils unless otherwise specified in Division 09, except:
  - .1 Interior Steel: Concealed

- .1 Surface preparation: to SSPC SP 3-89.
- .2 Primer: to CAN/CGSB-1.40-M89 (or equivalent) and Division 09.
- .2 Interior and Exterior Steel: Exposed
  - .1 Surface preparation: to SSPC SP 6-89 commercial blast cleaning using mechanical shot blast techniques unless otherwise specified in Division 09. Hand cleaning not permitted.
  - .2 Primer: One coat applied in accordance with architectural finish schedules.
- .3 Loose Lintels/Shelf Angles/Masonry Support Plates: Hot dipped galvanized.
- .4 Exterior Steel not noted in architectural finish schedules: Hot dipped galvanized.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

### **PART 3 Execution**

#### **3.01 GENERAL**

- .1 Structural steel work: in accordance with CAN/CSA-S16 and CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

#### **3.02 CONNECTION TO EXISTING WORK**

- .1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Consultant for direction before commencing fabrication.

#### **3.03 MARKINGS**

- .1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark bearing assemblies and splices for fit and match.

#### **3.04 ERECTION**

- .1 Check anchor bolt layout before erection. Arrange for discrepancies.
- .2 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and CAN/CSA-S136 in accordance with reviewed erection drawings.
- .3 Field cutting or altering structural members: to approval of Consultant in writing.
- .4 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .5 Continuously seal members by continuous welds where indicated. Grind smooth.
- .6 Use erection techniques and equipment that will not mark or abrade surfaces of exposed structural steel.

**3.05 FIELD QUALITY CONTROL**

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Consultant.
- .2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Engineer.
- .3 Submit test reports to Consultant within 1 week of completion of inspection.
- .4 Owner will pay costs of tests as specified in Division 1.

**3.06 FIELD PAINTING**

- .1 Paint in accordance with Division 9.
  - .1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP-6 except as specified otherwise. Apply in accordance with CAN/CGSB 85.10.

**3.07 GALVANIZING TOUCH-UP**

- .1 Touch up galvanized surfaces damaged during transportation, handling, storage, and erection and as a result of work of other sections.
- .2 Touch up in accordance with ASTM A780.
- .3 Clean damaged surfaces with stiff wire brush to remove rust, loose and cracked coatings.
- .4 Clean welds, bolted connections and abraded areas.
- .5 Apply galvanizing repair materials to match hot dip coating weight and appearance.

**END OF SECTION**



**PART 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 05310 - Steel Deck.
- .2 Section 05500 - Metal Fabrications.
- .3 Section 09900 - Painting.

**1.02 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.
  - .2 CAN/CGSB-1.105-M91, Quick Drying Primer.
  - .3 CAN/CGSB-85.10-99, Protective Coatings for Metals.
  - .4 CAN/CGSB-85.100-99, Painting.
- .2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
  - .1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.
  - .2 CISC/CPMA 1-73b Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-S16-01, Limit States Design of Steel Structures.
  - .3 CSA-S136-01, Cold Formed Steel Structural Members.
  - .4 CSA-W47.1-92 (R2001), Certification of Companies for Fusion Welding of Steel Structures.
  - .5 CSA-W55.3-1965 (R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .6 CSA-W59-M1989 (R2001), Welded Steel Construction (Metal Arc Welding).
  - .7 CSA-W59S1-M1989 (R2001), Supplement No.1-M1989, Steel Fixed Offshore Structures, to W59-M1989, Welded Steel Construction (Metal Arc Welding).

**1.03 QUALITY ASSURANCE**

- .1 Submit 5 copies of mill test reports at least 4 weeks prior to fabrication of steel joists and accessories. Reports to show:
  - .1 Chemical and physical properties.
  - .2 Other details of steel to be incorporated into work.
  - .3 Certification by qualified metallurgists confirming that tests conform to requirements of CSA G40.20/G40.21
- .2 Supply affidavit prepared by fabricator of structural steel joists stating that materials and products used in fabrication conform to this specification.

#### **1.04 DESIGN OF STEEL JOISTS AND BRIDGING**

- .1 Design steel joists and bridging to carry loads indicated on drawings in accordance with CAN/CSA-S16 and CSA-S136.
- .2 Design joists and anchorages for uplift forces as indicated and as per loading requirements of 1997 OBC.
- .3 Ensure joists are manufactured to consider load effects due to fabrication, erection and handling.
- .4 Floor Vibration & Excitation: Joists and joist properties are to be designed and fabricated to meet the vibration criteria outlined in the 2006 OBC, Clause 4.1.3.6 and as per Commentary D of the User's Guide – NBC 2005 – Structural Commentaries (Part 4 Division B). Joist design calculations/shop drawings to outline all vibration criteria used in the determination of the joist properties/resistance to Dynamic Loading and Response to Loads. Shop drawings to include appropriate floor frequency and % gravity acceleration limits.
- .5 Limit roof joist deflection due to specified live load to  $l/360$  of span and deflection due to specified total load to  $l/240$  of span.
- .6 Limit floor joist deflection due to specified live load to  $l/480$  of span and deflection due to specified total load to  $l/360$  of span.
- .7 Submit 5 copies of calculations and joist design drawings for typical joists for Consultant review at least 4 weeks prior to fabrication and/or delivery.
- .8 Joists are to be designed to accommodate loads from window washing anchors; patient lifts, and guy wires where applicable. Anchor locations and load requirements to be indicated on joist shop drawings and incorporated in to joist designs.

#### **1.05 SHOP DRAWINGS**

- .1 Submit shop details and erection drawings in accordance with Division 1.
- .2 Submit drawings stamped and signed by qualified professional engineer licensed in province of Ontario, Canada.
- .3 Indicate on erection drawings, relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage, window washing / guy wire anchors / lift locations and details.
- .4 Provide particulars, on shop drawings, relative to joist geometry, framed openings, splicing details, bearing and anchorage. Include member size, properties, specified and factored member loads, and stresses under various loadings, deflection and camber. Products

### **PART 2 Products**

#### **2.01 MATERIALS**

- .1 Open web steel joists:
- .2 Acceptable material: Structural steel: to CSA-G40.20/G40.21 and CSA-S136.
- .3 Structural steel: to CSA-G40.20/G40.21 and CSA-S136.
- .4 Welding materials: to CSA-W59 with CSA-W59S1.
- .5 Shop paint primer: to CISC/CPMA-2.

**2.02 FABRICATION**

- .1 Fabricate steel joists and accessories as indicated in accordance with CAN/CSA- S16.1 and in accordance with reviewed shop drawings.
- .2 Weld in accordance with CSA-W59 and with CSA-W59S1.
- .3 Provide top and bottom chord extensions where indicated.
- .4 Provide diagonal and horizontal bridgings and anchorages as indicated.

**2.03 SHOP PAINTING**

- .1 Clean, prepare and shop prime surfaces of steel joists to CAN/CSA-S16.
- .2 Clean members of loose mill scale, rust, oil, dirt and other foreign matter. Prepare surfaces in accordance with SSPC SP1 brush blast.
- .3 Apply one coat of CISC/CPMA 2 primer to steel surfaces to achieve maximum dry film thickness of .065 mm to .080 mm (0.0025" to 0.0032").
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

**PART 3 Execution**

**3.01 GENERAL**

- .1 Structural steel work: in accordance with CAN/CSA-S16 and CSA-S136.
- .2 Welding: in accordance with CSA-W59 and with CSA-W59S1.
- .3 Companies to be certified under Division 1 or 2.1 of CSA-W47.1 for fusion welding and/or CSA-W55.3 for resistance welding.
- .4 Provide certification that welded joints are qualified by Canadian Welding Bureau.

**3.02 CONNECTION TO EXISTING WORK**

- .1 Verify dimensions and condition of existing work; report discrepancies and potential problem areas to Consultant for direction before commencing fabrication.

**3.03 FIELD QUALITY CONTROL**

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Consultant.
- .2 Testing laboratory will inspect representative joists for integrity, accuracy of fabrication and soundness of welds. Testing laboratory will also monitor test loading of joists used by manufacturer to verify design and check representative field connections. Consultant will determine extent of and identify all inspections.
- .3 Submit test report to Consultant within 7 days after completion of inspection.
- .4 Owner will pay costs of tests as specified in Division 1.

**3.04 ERECTION**

- .1 Erect steel joists and bridging as indicated in accordance with CAN/CSA-S16 and in accordance with reviewed erection drawings.
- .2 Complete installation of all bridging and anchorages before placing construction loads on joists.
- .3 Field cutting or altering joists or bridging that are not shown on shop drawings: to approval of Consultant in writing.
- .4 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

**3.05 FIELD PAINTING**

- .1 Paint: in accordance with Division 9.
- .2 Touch up all damaged surfaces and surfaces without shop coat with CISC/CPMA-2 in accordance with manufacturers' recommendations to CAN/CGSB-85.10.

**END OF SECTION**

**PART 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 05 12 23 - Structural Steel for Buildings.
- .2 Section 03 30 00 – Cast-In Place Concrete

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A 653/A653M-07, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM A 792/A792M-06a, Specification for Steel Sheet, 55%Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International).
  - .1 CSA C22.2 No.79-1978(R1999), Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
  - .2 CAN/CSA-S16.1-01(05), Limit States Design of Steel Structures.
  - .3 CSA-S136-07, Cold Formed Steel Structural Members.
  - .4 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.
  - .5 CSA W55.3-1965(R2003), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .6 CSA W59-M1989(R2001), Welded Steel Construction, (Metal Arc Welding).
- .4 Canadian Sheet Steel Building Institute (CSSBI)
  - .1 CSSBI 10M-96, Standard for Steel Roof Deck.
  - .2 CSSBI 12M-96, Standard for Composite Steel Deck.

**1.03 DESIGN REQUIREMENTS**

- .1 Design steel deck using limit states design in accordance with CSA S136.
- .2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.
- .3 Deflection under specified live load not to exceed 1/240 of span, except that when ceilings are hung directly from deck, live load deflection not to exceed 1/360 of span.
- .4 Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CAN/CSA-S16.1, Appendix 'G'.

**1.04 SHOP DRAWINGS**

- .1 Submit shop drawings erection and shoring drawings in accordance with Division 1.
- .2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Submit design calculations if requested by Consultant.

- .4 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.
- .5 Contractor shall coordinate and cross check for accuracy, completeness and correct relationship of the work of other Sections, each shop drawing prepared for the work of this Section, including each shop drawing prepared by accepted subcontractors. Engineer's review of shop drawings does not relieve Contractor of these responsibilities.
- .6 Indicate gauge, grade of steel and galvanizing for each piece.
- .7 Show and dimension holes through deck and other work required for work of other Sections. Provide fieldwork drawings for holes not shown in shop drawings.
- .8 Deviations: Requests for deviations from the Drawings or Specifications shall be submitted on Contractor's letterhead. Acceptance of shop drawings including deviations not detected during shop drawing review will not relieve Contractor from responsibility to conform strictly to the Contract Documents. Deviations will be allowed only where permitted by the Engineer in writing. Proposed deviations must be accompanied by documented and physical evidence that will establish that quality of proposed deviation equals or exceeds the quality specified.
- .9 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete fill decks.

**1.05 WORK INCLUDED**

- .1 Extent of steel deck and shear connectors is indicated on the Drawings, including basic layout and type of steel deck units required.
- .2 Provide all labor, materials, equipment and services, and perform all operations required for complete furnishing, fabrication and installation of all steel deck and shear connectors and related work as indicated on the Drawings, specified in this Section and required by job conditions.
- .3
  - .3 The work shall include, but not be limited to the following:
    - .1 Steel roof, floor and form deck.
    - .2 Pour stops around the building perimeter and at all openings, end closures, closure plates around all columns and work of other trades and any other accessories required.
    - .3 Saddles, valley plates and sump pans.
    - .4 Deck supports not shown or specified under other Sections, but necessary for the proper support of deck and applied loads.
    - .5 Shoring of deck where shown in the Drawings and where required to properly support applied loads and/or maintain uniform concrete slab thickness and maintain specified floor finish tolerances.
    - .6 Cutting and forming of holes and openings through steel deck, including the reinforcing of deck to safely support both temporary and permanent construction.
    - .7 Hanger tabs and other vertical supports for ceilings and other lightweight devices.
    - .8 Field-applied shear connectors.
    - .9 Field-applied deformed anchor bars stud welded to structural steel.
    - .10 Touch-up painting in the field.
    - .11 Erection drawings, shop drawings and samples.
    - .12 Protection of work of this Section.
    - .13 Protection of other work from other activities under this Section.

- .14 Submittals.
- .15 Provisions for other work.
- .16 All other work shown in the Drawings, specified in this Section or required to make the work complete.
- .17 Contractor's Responsibilities: The Contractor shall be solely responsible for the items listed below. While the following list is not intended to be a complete listing of all responsibilities, it is provided to bring these items to the specific attention of the Contractor. Engineer's review of shop drawings or other submittals, presence or observation at the project site, or performance or waiving of inspection or testing, does not relieve Contractor from these responsibilities.
  - .1 Design, engineering, construction, safety and adequacy of all steel deck work acting as a concrete form. Design and construct deck as a form to withstand all imposed forces, including all construction dead and live loads, horizontal loads from equipment and wind and forces due to vibration of plastic concrete. Provide inspection of all steel deck as a form for conformance with this Specification.
  - .2 Safety and stability of the work. Construction sequences, whether stated or implied, are intended only to assist the Contractor in coordinating the work of the project.
  - .3 Fabrication procedures and the means, methods, techniques, sequences and procedures of construction.
  - .4 Correctness of dimensions and quantities, for the fitting to other or existing elements, for conditions to be confirmed and correlated at the site, and for the verification of the physical interrelationships of elements of the work.
  - .5 The amount, method of distribution, and proposed supplemental support of loads during construction. Construction loads shall not exceed the superimposed load that the member, with necessary supplemental support, is capable of carrying safely without damage.
  - .6 Obtain all field measurements required for proper fabrication and installation of work covered by this Section. Precise measurements are the responsibility of Contractor.
  - .7 Report unsatisfactory or non conforming conditions to the Engineer in writing prior to the start of work.
- .18 Deficient work or any work failing to strictly conform to the Contract Documents shall be removed and replaced, or repaired if accepted by Engineer, at no cost to the Owner, Architect or Engineer.
  - .1 Contractor shall prepare appropriate details and procedures to bring such work into conformance with the Contract Documents and submit to Engineer for review and acceptance. All drawings and details of proposed corrective work shall be neatly and clearly drafted in scale clearly identifying location and extend of such work. Contractor shall, through the Owner, reimburse the Engineer for time and expense incurred reviewing proposal procedures and details in accordance with the Engineer's current fee schedule.
  - .2 Non-conforming work may be rejected by Owner, Architect or Engineer at any time, regardless of prior acceptance in shop drawings, prior inspection, inclusions in certificates of payment.
  - .3 Deficient work shall include, but not be limited to:
    - .1 Bent or warped pieces.
    - .2 Weld damage to include:
      - .1 Deck burn through.

- .2 Undersized welds.
- .3 Damage to structural components.
- .4 Damage to deck coating or paint.
- .3 Unauthorized cutting.
- .4 Surface defects.
- .5 Surfaces not sufficiently clean to receive stud shear connector or spray fireproofing.
- .6 Workmanship not in accordance with the Drawings, with this Specification, with accepted samples, or with referenced codes or standards.
- .7 Exceeding tolerances.

## **PART 2 Products**

### **2.01 MATERIALS**

- .1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A 653/A653M structural quality Grade A, with ZF75 coating, for interior surfaces not exposed to weather, finish, 20ga. minimum base steel thickness.
- .2 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.
- .3 Zinc (Z) coated steel sheet: to ASTM A 653/A653M structural quality Grade A, with ZF75, coating, regular spangle surface, chemically treated for unpainted finish, not chemically treated for paint finish, for exterior surfaces exposed to weather, 18ga. minimum base steel thickness.
- .4 Closures: as indicated in accordance with manufacturer's recommendations.
- .5 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 1.22 mm (18ga). Metallic coating same as deck material.
- .6 Primer: zinc rich, ready mix to CAN/CGSB-1.181.
- .7 Caulking: to Division 7.
- .8 Shear studs: to CSA W59.

### **2.02 TYPES OF DECKING**

- .1 For decks not supporting concrete provide: 1.22 mm (18ga) minimum base steel thickness (galv), 38 mm (1 ½") maximum deep profile, non-cellular, interlocking side laps or as noted on drawings. Attachment Pattern: Welds shall be 20 mm (¾") dia. fusion welds at 914/7 pattern and at 150 mm (6") centres on side supports (longitudinal welds), or as noted on drawings. Mechanically clinch side joints at 150 mm (6") centres, or as noted on drawings
- .2 For decks supporting concrete provide composite steel deck: 1.22 mm (18ga) minimum base steel thickness (galv), 38 mm (1 ½") deep profile, upright embossed fluted profile, interlocking side laps, or as noted on drawings. Attachment Pattern: Welds shall be 20 mm (¾") dia. fusion welds at 914/7 pattern and at 150 mm (6") centres on side supports (longitudinal welds), or as noted on drawings. Mechanically clinch side joints at 150 mm (6") centres, or as noted on drawings.



**PART 3 Execution**

**3.01 GENERAL**

- .1 Structural steel work: in accordance with CAN/CSA-S136 and CSSBI 10M and CSSBI 12M.
- .2 Welding: in accordance with CSA W59, except where specified otherwise.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

**3.02 ERECTION**

- .1 Erect steel deck as indicated and in accordance with CSA S136 CSSBI 10M and CSSBI 12M and in accordance with reviewed erection drawings.
- .2 Lap ends: to 150 mm (6") minimum.
  - .1 Weld deck to structural steel. Welds shall be 20 mm (¾") dia. fusion welds at 914/7 pattern and at 150 mm (6") centres on side supports (longitudinal welds), or as noted on drawings. Mechanically clinch side joints at 150 mm (6") centres, or as noted on drawings.
- .3 Weld and test stud shear connectors through steel deck to steel joists/beams below in accordance with CSA W59.
- .4 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.
- .5 Prior to concrete placement, steel deck to be free of soil, debris, standing water, loose mill scale and other foreign matter.
- .6 Temporary shoring, if required, to be designed to support construction loads, wet concrete and other construction equipment. Do not remove temporary shoring until concrete attains 75% of its specified 28 day compression strength.
- .7 Place and support reinforcing steel as indicated.
- .8 Block flutes solid below mechanical units, sleepers; point loads, unless otherwise indicated.

**3.03 CLOSURES**

- .1 Install closures in accordance with approved details.

**3.04 OPENINGS AND AREAS OF CONCENTRATED LOADS**

- .1 No reinforcement required for openings cut in deck which are smaller than 150 mm (6") square.
- .2 Frame deck openings with any one dimension between 150 mm to 300 mm (6" to 12") as recommended by manufacturer, except as otherwise indicated.
- .3 . For deck openings with any one dimension greater than 300 mm (12") and for areas of concentrated load, reinforce in accordance with structural framing details (minimum: 1 3/4 x 1 3/4 x 3/16 inch angle perpendicular to ribs of deck at each end of hole extending 16 inches beyond hole and welded to top side of deck), except as otherwise indicated.

**3.05 CONNECTIONS**

- .1 Install connections in accordance with CSSBI recommendations as indicated.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 05 51 00 - Metal Stairs.
- .2 Section 09 91 23 - Painting.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A123/A123M-15. Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A307-14. Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
- .2 CSA Group.
  - .1 CSA-G40.20-13/G40.21-13. General Requirements For Rolled Or Welded Structural Quality Steel / Structural Quality Steel.
  - .2 CSA-S16-14. Design of steel structures.
  - .3 CSA-W48-14. Filler metals and allied materials for metal arc welding.
  - .4 CSA-W59-13. Welded Steel Construction (Metal Arc Welding).

**1.03 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of WHMIS MSDS. Indicate VOC's for primers, coatings and paints.
- .3 Submit manufacturer's printed product literature, specifications and data sheet
- .4 Submit Shop Drawings:
  - .1 Indicate construction details, materials, core thicknesses, finishes.
  - .2 Indicate sizes of metal sections and thickness of metal sheet.
  - .3 Indicate connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories. On installation drawings, indicate all information necessary for assembly, including member size, base plate elevation, anchor bolt size and location.
  - .4 Indicate cuts, copes, holes, threaded fasteners, rivets and welds. Indicate welds by AWS welding symbols.
  - .5 Provide Shop Drawings stamped and signed by qualified Professional Engineer licensed in the Province of Ontario for all fabricator designed assemblies, components and connections.
- .5 Closeout Submittals: Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.04 QUALITY ASSURANCE**

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

**1.05 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Steel sections and plates: to CSA-G40.20/G40.21, Grade 350W. Checker plate pattern where indicated.
- .2 Welding materials: to CSA-W59.
- .3 Welding electrodes: to CSA-W48 Series.
- .4 Grout: non-shrink, non-metallic, flowable. Compressive strength: 5 MPa at 24 hours.
- .5 Wood framing: 38 mm thick pressure treated lumber as specified in Section 06 10 00 - Rough Carpentry.
- .6 Sealants: as specified in Section 07 92 10 - Joint Sealing.
- .7 Shop Primers.
  - .1 2 component epoxy primer compatible with MPI formula INT 5.1N as specified in Section 09 91 23 - Painting.
  - .2 Touch up primer for galvanized items: zinc rich primer.

**2.02 FINISHING**

- .1 Exterior application: Unless indicated otherwise, all exterior fabricated steel items are to be galvanized after fabrication: Hot dipped galvanizing with zinc coating: Thickness 600 g per square meter to ASTM A123/A123M.
- .2 Interior application: Unless indicated otherwise, after completion of fabrication processes all interior fabricated steel items are to be shop primed with one coat of shop primer.
  - .1 Interior components: apply one coat of shop primer. Minimum 0.051 mm, maximum 0.076 mm dry thickness.
  - .2 Clean, prepare surfaces and apply primer in accordance with CSA-S16. Apply one shop coat of shop primer to metal items, with exception of galvanized or concrete encased items.
  - .3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale or grease. Do not paint when temperature is lower than 7 degrees C.
  - .4 Clean surfaces to be field welded. Do not paint.
  - .5 Finish Paint: site applied primer and finish coats as specified in Section 09 91 23 - Painting.

**2.03 FASTENERS**

- .1 Bolts and anchor bolts: to ASTM A307. Provide stainless steel bolts, washers and nuts where indicated. Provide stainless steel acorn nuts where indicated.
- .2 Fasteners: steel, type and size as specified by the structural engineer responsible for the shop drawings. Exposed fasteners to be finished to match the finish on the item being fastened.

**2.04 FABRICATION**

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur. Use self-tapping shake-proof screws on items requiring assembly by screws or as indicated. Provide wall and floor anchors as indicated or required for attachment.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Accurately form connections with exposed faces flush; mitres and joints tight. Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .5 Fabricate items to receive galvanized finish in largest practical sizes. Do not field weld galvanized items.

**2.05 METAL FABRICATION SCHEDULE**

- .1 Refer to drawings for detailing and sizes of all metal fabrications.
- .2 The following Schedule is not a complete or comprehensive itemized listing of all components that are required for this project.
- .3 Angle Lintel.
  - .1 Steel angles: sizes indicated for openings. Provide 150 mm minimum bearing at ends. Weld or bolt back-to-back angles to profiles as indicated.
  - .2 Finish: Shop primer for interior. Shop Zinc-rich primer for exterior.
- .4 Overhead Door Frame.
  - .1 Fabricate frames for overhead doors from steel, sizes, shapes and profile as indicated.
  - .2 Weld plate steel and structural shapes together to form continuous frame for jambs and head of openings. Size and shapes as indicated.
  - .3 Weld steel strap anchors to channel jamb frame.
  - .4 Finish: Hot Dip Galvanized after fabrication for exterior applications.
- .5 Recessed Pit Frame.
  - .1 Steel: fabricate from 6 mm thick raised pattern plate set in L 55 x 55 x 6 frame. Include anchors at 1200 mm on centre for embedding in concrete. Supply pit cover in maximum size of 1200 x 1200 mm sections. Fabricate covers for larger pits in multiple, equal sized sections.
  - .2 Finish: Hot Dip Galvanized after fabrication.
- .6 Bollards.
  - .1 Fabricate bollards from HSS. Diameter, thickness and length as indicated.
  - .2 Finish: Hot dipped galvanized after fabrication.

**Part 3 Execution**

**3.01 ERECTION**

- .1 Install all metal fabrications indicated in the drawings.
- .2 Do welding work in accordance with CSA-W59 unless specified otherwise.

- .3 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .4 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .5 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .6 Provide components for building by other sections in accordance with shop drawings and schedule.
- .7 Make field connections with bolts to CSA-S16.1, or weld.
- .8 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .9 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .10 No field welding for hot dip galvanized items. Touch-up galvanized surfaces with zinc rich primer.

### **3.02 BOLLARDS**

- .1 Install bollards as detailed. Set bollards vertically in drilled hole. Fill hole with concrete. Top surface of concrete flush with surrounding grade.
- .2 Fill bollard with concrete. Shape top surface of concrete into smooth dome.
- .3 Clean galvanized finish free of concrete.

### **3.03 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 When installation is complete, remove protective coating and clean surfaces in accordance with the coating manufacturer's instructions. Use only cleaning methods and materials recommended by the coating manufacturer.
- .3 Repair or replace damage products.
- .4 Make good any damage caused by the work of this Section.
- .5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 05 50 00 - Metal Fabrications.
- .3 Section 09 91 23 - Painting.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A307-14. Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
  - .2 ASTM F3125/F3125M-15a. Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
- .2 CSA Group.
  - .1 CSA-G40.20-13/G40.21-13. General Requirements For Rolled Or Welded Structural Quality Steel / Structural Quality Steel.
  - .2 CSA-S16-14. Design of steel structures.
  - .3 CSA-W48-14. Filler metals and allied materials for metal arc welding.
  - .4 CSA-W59-13. Welded Steel Construction (Metal Arc Welding).
- .3 National Association of Architectural Metal Manufacturers (NAAMM).
  - .1 NAAMM AMP 510-92. Metal Stairs Manual.

**1.03 SYSTEM DESCRIPTION**

- .1 Design metal stair, balustrade and landing construction and connections to NBC vertical and horizontal live load requirements.
- .2 Fabricate stair assembly to support a minimum uniform live load of 4.7 kPa and a concentrated load of 14 kPa with deflection of stringer or landing framing not to exceed 1/240 of span.
- .3 Fabricate railing assembly, wall rails, and attachments to resist lateral force of 333 N at any point without damage or permanent set.
- .4 Concrete Filled Steel Pan Stairs: Detail and fabricate steel pan stairs to NAAMM AMP 510, Metal Stairs Manual and as indicated in the drawings. Commercial Class system. Concrete filled steel pan assembly. **Painted Metal Bar Balustrades and handrail supports.**
- .5 Handrail assembly: Custom vertical metal supports clad with wood and lightweight metal cladding as detailed.**

**1.04 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, specifications and data sheet.
- .3 Submit shop drawings.
  - .1 Indicate construction details, materials, core thicknesses, finishes.

- .2 Indicate sizes of steel sections and thickness of steel sheet. Indicate thickness and profiles for each component.
- .3 Indicate connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories. On installation drawings, indicate all information necessary for assembly, including member size, base plate elevation, anchor bolt size and location. Include installation instructions.
- .4 Indicate cuts, copes, holes, threaded fasteners, rivets and welds. Indicate welds by AWS welding symbols.
- .5 Provide Shop Drawings stamped and signed by qualified Professional Engineer licensed in the Province of Ontario for all fabricator designed assemblies, components and connections.

**1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.06 QUALITY ASSURANCE**

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

**1.07 DELIVERY, STORAGE, AND HANDLING**

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

**Part 2 Products**

**2.01 MATERIALS**

- .1 Steel sections: to CSA-G40.20/G40.21 Grade 300 W.
- .2 Steel plate: to CSA-G40.20/G40.21, Grade 260 W.
- .3 Floor plate: to CSA-G40.20/G40.21, Grade 260 W. Thickness 3 mm minimum or as per NAAMM AMP 510.
- .4 **Perforated steel cladding:**
  - .1 **Steel Type:**
  - .2 **Perforations: Round? Percentage of open? Pattern?**
  - .3 **Thickness: ?**
- .5 Welding materials: to CSA-W59. Welding electrodes: to CSA-W48 Series.
- .6 Bolts and anchor bolts: to ASTM A307. Provide stainless steel bolts, washers and nuts where indicated. Provide stainless steel acorn nuts where indicated.
- .7 High strength bolts: to ASTM F3125/F3125M.
- .8 Fasteners: steel, type and size as specified by the structural engineer responsible for the shop drawings. Exposed fasteners to be finished to match the finish on the item being fastened.



- .9 Grout: non-shrink, non-metallic, flowable. Compressive strength: 5 MPa at 24 hours.
- .10 Safety stair nosing: pre-fabricated nosing intended for installation into cast concrete of stair treads and landings:
  - .1 Base: extruded aluminum alloy 6063-T5. "C" shaped profile with integrally cast arrow shaped anchor profile. Casting to include serrations and shaped to provide additional mechanical interlock with filler.
  - .2 Filler: anti slip filler: minimum 60 % virgin grain aluminum oxide abrasive mixed with epoxy resin binder. Filler securely bonded to the aluminum base.
  - .3 Dimensions: tread 55 mm (2 1/16 inches) wide x 9.5 mm (3/8 inch) thick with continuous arrow profile anchor 15.8 mm (5/8 inches) deep.
  - .4 Colour: selected by Consultant from full range of available colours. Colour to extend uniformly throughout the filler layer.
  - .5 Extend nosings full width of stair tread less 25 mm for clearance.
  - .6 Install into treads and landings before initial set of the concrete. Set nosings flush with the top of the traffic surface.
- .11 Concrete fill: Minimum 25 MPa as specified in Section 03 30 00 - Cast-in-Place Concrete.

## 2.02 FABRICATION

- .1 Fabricate to NAAMM AMP 510 - Metal Stair Manual and as indicated in the drawings.
- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .3 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur. Use self-tapping shake-proof screws on items requiring assembly by screws or as indicated. Provide wall and floor anchors as indicated or required for attachment.
- .4 Make risers of equal height.
- .5 Accurately form connections with exposed faces flush and with mitres and joints tight. Ensure exposed welds are continuous for length of each joint. Grind or file exposed welds and steel sections smooth.
- .6 Shop fabricate stairs in sections as large and complete as practicable. Where indicated, provide bolted connections to allow for site assembly without welding.

## 2.03 CONCRETE FILLED STEEL PAN STAIRS

- .1 Fabricate Commercial Class stairs with closed riser steel pan construction. Concrete filled tread and landings.
- .2 Fabricate pans to accept concrete fill. Concrete mix design as specified in Section 03 30 00 - Cast-in-Place Concrete.
- .3 Form treads and risers from 3 mm thick steel plate. Secure treads and risers to L 35 x 35 x 5 horizontal and vertical angles welded to stringers. CONFIRM DETAIL?**
- .4 Form wall stringers from MC 310 x 15.8. CONFIRM DETAIL?**
- .5 Form outer stringers from MC 310 x 15.8 with 5 mm thick plate fascia welded on. CONFIRM DETAIL**
- .6 Form landings from 3 mm thick steel plate, reinforced by L 55 x 55 x 6 mm spaced at 400 mm on centre.

- .7 Provide clip angles for fastening of furring channels, where applied finish is indicated for underside of stairs and landings.
- .8 Extend stringers around mid landings to form steel base.
- .9 Close ends of stringers where exposed.
- .10 Fabricate riser and run to suit the tread and riser finish providing equal rise heights. Refer to drawings for floor finish for each stair assembly.
- .11 Prime paint all components ready for site application of finish paint as specified in Section 09 91 23 - Painting.

#### **2.04 HANDRAILS**

- .1 Fabricate custom designed, painted metal bar balustrades with interior wood cladding and rails. Exterior of handrail assembly clad with perforated steel as detailed.
- .2 Fabricate vertical supports with welded connections and attachments to stringers and landings.
- .3 Fabricate for welded connection to mounting bars cast into concrete landings. CONFIRM DETAIL?**
- .4 Shop apply primer and prepare for finish paint as specified in Section 09 91 23 - Painting. CONFIRM FINISH OF STEEL COMPONENTS.**

#### **2.05 SHOP FINISHES**

- .1 Shop Primer: 2 component epoxy primer compatible with MPI formula INT 5.1N as specified in Section 09 91 23 - Painting.

#### **2.06 SHOP PAINTING**

- .1 Interior application: Unless indicated otherwise, after completion of fabrication processes all interior fabricated steel items are to be shop primed.
  - .1 Interior components: apply one coat of shop primer. Minimum 2.0 mil, maximum 3.0 mil dry film thickness.
  - .2 Clean, prepare surfaces and apply primer to CSA-S16. Apply one shop coat of primer to metal items, with exception of concrete encased items.
  - .3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale or grease. Do not paint when temperature is lower than 7 degrees C.
  - .4 Clean surfaces to be field welded. Do not apply primer.
  - .5 Apply two coats of primer of different colours to parts inaccessible after final assembly.
  - .6 Finish Paint: site applied primer and finish coats as specified in Section 09 91 23 - Painting.
- .2 Do not apply shop primer to interior surfaces of pans.

### **Part 3 Execution**

#### **3.01 INSTALLATION OF STAIRS**

- .1 Install in accordance with NAAMM, Metal Stair Manual.
- .2 Install components plumb and level, accurately fitted, free from distortion or defects and in accordance with manufacturer's written instructions.

- .3 Install in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates, angles, hangers and struts required for connecting stairs to structure.
- .4 Make field connections with high strength steel bolts to ASTM A325 or weld.
- .5 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .6 Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- .7 Field weld components indicated on reviewed Shop Drawings. Perform field welding in accordance with CSA-W59.
- .8 Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- .9 Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.
- .10 Obtain approval prior to site cutting or creating adjustments not scheduled.
- .11 After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete. Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.
- .12 Install stairs such that the risers are equal height after the installation of the Finished Floor on the treads and landings.

### **3.02 CONCRETE FILL**

- .1 Fill pans of landings and treads with Concrete as specified in Section 03 30 00 - Cast-in - Place Concrete.
- .2 Fill pans to top edge. Vibrate to eliminate voids. Strike flush with edges of pans. Trowel to smooth, flat, blemish free surface free of tool marks.
- .3 Set concrete fill level as required to suit installation of floor finish in treads and landings. Top edge of floor finish to sit flush with top edge of steel pan unless detailed otherwise.

### **3.03 FIELD PAINTING**

- .1 Site apply primer and two finish coats of paint to all exposed metal components of stairs, landings and handrails as specified in Section 09 91 23 - Interior Painting. CONFIRM FINISH?**

### **3.04 CLEANING**

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt. Clean handrails immediately prior to final inspection.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**PART 1 General**

**1.01 SYSTEM DESCRIPTION**

- .1 Design, fabrication and installation of structural glass guardrail systems without any top applied cap or railing including all related accessories.
  - .1 Engineered, through glass, point supported, stand off glass guardrail assembly. Face mounted to wall and edge of floor structure using stand off fittings.
  - .2 Engineered, base moulding, glass guardrail assembly. Base moulding recess mounted to structural floor assembly.
  - .3 Installation of laminated, tempered glass panels.
- .2 Design, fabrication and installation of frameless structural glass wall panels including tempered glass panels and swinging doors. Wall panels to extend down from guardrail system and incorporate swinging doors into the assembly. Panels to be full height, fastened at the top to the standoff fittings used for the glazed guardrails and with a U channel fittings along the bottom edge. Design panel joints with caulked seams without any applied trim or fittings.

**1.02 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.
- .2 Section 08 71 00 - Door Hardware.
- .3 Section 08 81 00 - Glass Glazing.

**1.03 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A276/A276M-16a. Standard Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM A582/A582M-12e1. Standard Specification for Free-Machining Stainless Steel Bars.
  - .3 ASTM A666-15. Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  - .4 ASTM B221-14. Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - .5 ASTM E1300-12ae1. Standard Practice for Determining Load Resistance of Glass in Buildings.

**1.04 DESIGN REQUIREMENTS**

- .1 Design guardrails including attachments in accordance with National Building Code (NBC) as well as all local and provincial requirements to withstand structural loads without exceeding the allowable working stresses of the materials.
- .2 Design components to withstand dead and live loads, acting normal to plane of system as determined in accordance with NBC and as follows:
  - .1 Support distributed horizontal load of 50 pounds per linear foot (0.73kN/M), applied at right angles in any direction to the top rail.
  - .2 Support concentrated horizontal load of 200 pounds (0.89kN), applied in any direction at any point along top rail.
  - .3 Support concentrated load of 50 lbs (0.22kN) on 1 square foot (0.093m<sup>2</sup>) perpendicular to guard at any location in the system.

- .4 Support a distributed vertical load of 100 pounds per linear foot applied at the top and transfer this load through the supports to the building structure.
- .5 Loads need not to be assumed to act concurrently.
- .6 Maximum deflection at top of glass is height/24.
- .3 Design glass thickness and maximum glass unit dimensions to limits in accordance with ASTM E1300.
- .4 Design system to accommodate the following, without damage to components:
  - .1 Movement within system.
  - .2 Movement between guardrail and adjacent building components.
  - .3 Ensure no vibration harmonics, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.
- .5 Design vertical glazed wall assembly to withstand normal operation without damage, racking, sagging, or deflection.

#### 1.05 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data. Submit Manufacturer's technical product data for all components and accessories.
- .3 Submit Shop Drawings: provide dimensioned drawings of guardrail assemblies indicating the following:
  - .1 Submit Shop Drawings prepared, sealed and signed by a Professional Engineer registered in the Province of Ontario.
  - .2 Indicate materials and profiles and provide full size, scaled details for all components. Indicate trim and junctions with adjacent construction. Indicate junctions between units. Indicate core thicknesses of all components.
  - .3 Indicate: type and location of exposed finishes, method of anchorage, number of anchors, supports, fasteners, reinforcement, accessories. Indicate location of caulking. Indicate arrangement of hardware and required clearances to surrounding structure.
  - .4 Provide structural and physical characteristics of members and anchors. Indicate dimensional limitations and special installation requirements.
  - .5 Submit glass fabrication plans with dimensions, holes and finishes.
  - .6 Provide elevations. Include joint locations, transitions, and terminations.
  - .7 Indicate point support layout, details and attachment to support structure.
  - .8 Indicate assembly details and dimensions of fabrication.
  - .9 Submit details for vertical wall panels. Indicate sizes of bottom trim, installation details. Indicate details on caulked seams. Provide description of all hardware including door hardware for swinging door assembly.
  - .10 Submit manufacturer's handling and installation instructions. Indicate installation details and sequencing. Indicate method of glass installation.
  - .11 Indicate system dimensions and tolerances, adjacent construction, anticipated deflection under load and field splices required.
- .4 Submit Engineering Design Report.
  - .1 Include calculations showing point support reactions and glass stresses.
  - .2 Provide design requirements for all anchors and support connections.

- .3 Submit certified test reports from accepted or designated, independent testing laboratories, indicating compliance with specifications for specified physical properties.
- .4 Submit manufacturer's product certificates, signed by manufacturer, certifying that materials comply with specified physical properties and performance characteristics.
- .5 Provide samples.
  - .1 Submit duplicate 300 x 300 mm sample pieces of glass panels.
  - .2 Submit duplicate samples of each fitting. Submit duplicate samples of anchors.
  - .3 Submit sample of base moulding.
  - .4 Submit samples of door hardware. Samples will be returned for use after review and approval.
  - .5 Submit samples of manufacturer's finishes.
- .6 Closeout Submittals: Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals. Submit Manufacturer's maintenance instructions

#### **1.06 QUALITY ASSURANCE**

- .1 Obtain guardrails, components and fittings from single manufacturer.
- .2 Fabricate all glass by an approved temperer to a tolerance of 1.0 mm for the light size and hole locations.
- .3 Installer Qualifications: company or person specializing in Guardrail installations with 5 years documented experience. Approved by Manufacturer.
- .4 Construct mock-ups in accordance with Section 01450 - Quality Control.
  - .1 Provide 5.00 m long mock-up section including stand off section, base moulding, corner detail and glass panels. Assemble to illustrate component assembly including glazing materials, attachments and anchors. Mock-up to include corner junction.
  - .2 Locate where directed by Consultant.
  - .3 Allow 24 hours for inspection of mock-up before proceeding with work.
  - .4 When accepted, mock-up will demonstrate minimum standard for this work. Approved mock-up may remain as part of finished work.
- .5 Conduct pre-installation meeting one week prior to commencing work and on-site installations, to verify project requirements, co-ordinate with other construction trades, establish progress of construction and manufacturer's installation instructions.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver store and handle materials in accordance with manufacturer's written instructions.
- .3 Deliver materials to the job site in good condition and adequately protected against damage. Store on site in a location and manner to avoid damage. Prevent bending. Store material in a clean, dry location away from uncured concrete and masonry.
- .4 Keep handling on site to a minimum. Exercise caution to avoid damage to finishes of material.
- .5 Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.08 AMBIENT CONDITIONS**

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

**PART 2 Products**

**2.01 MATERIALS**

- .1 Stainless Steel components: to ASTM A666 or ASTM A582/A582M. Type 304.
- .2 Extruded aluminum: to ASTM B221. Aluminum Association alloy AA6063-T52. Alloy and temper to suit intended purpose. Manufacturers standard profiles.
- .3 Surface fasteners: stainless steel, to ASTM A276/A276M. 300 series or 400 series of sufficient size and quantity to suit their intended purpose.
- .4 Anchors: material type, grade, diameter and length: sufficient to meet design loads. Expanding wedge bolt as recommended by manufacturer. Spacing as recommended by manufacturer to suit structural design.
- .5 Glass: 17.52 mm thick, laminated, tempered glass. Type TL as specified in Section 08 81 00 - Glass Glazing.
- .6 Setting blocks: Neoprene. Durometer hardness as recommended by manufacturer, length of 25 mm for each square meter of glazing. Minimum 100 mm long x width of glazing rabbet space.
- .7 Sealant: structural silicone sealant: one component, high modulus, neutral curing silicone sealant intended for structural bonding of glass, metal and other materials. Excellent adhesion to a wide range of materials.
- .8 Door hardware: swinging door hardware as specified in Section 08 71 00 - Door Hardware.

**2.02 COMPONENTS**

- .1 Point supported standoff systems: cast, forged or machined solid stainless steel. Type 304 or 316.
  - .1 Standoff base, standoff nut. Manufacturers proprietary system. Cylindrical profile. Diameter: 50 mm. Base to suit hanger bolt, expanding bolt or threaded rod for attachment to steel or concrete structure.
  - .2 Lateral support brackets: Manufacturers proprietary system. Structural brackets to support and tie adjacent panels together where there is no support immediately behind glass panel. Length and size to suit design loads. Rounded ends to suit profile of standoff base support.
  - .3 Height of standoff base: as indicated in the drawings.
  - .4 Finish: number 4 (220 grit) brushed.
  - .5 Bushings, spacers, gaskets, sleeves and bearing pads: manufacturers standard components to suit design loading.
  - .6 Anchors: threaded rod or hanger bolts to suit substructure. Types, diameter and lengths as indicated in shop drawings and engineering report.
- .2 Base moulding system:
  - .1 Manufacturer's proprietary system. 70 mm wide x 75 mm high, extruded aluminum casting for attaching to floor structure. Provide matching 3 mm thick end caps for all ends. Provide in maximum available lengths to eliminate splices. Prepare base moulding for either vertical or horizontal attachment to structure as required.

- .2 Prepare for attachment to structural steel. Use structural stainless steel socket head cap screw. Type, style, diameter, length and spacing to suit design.
- .3 Dry glazing system for base moulding: proprietary dry glazed lock gasket system, complete with compatible spacers, tapers and setting blocks.
- .3 Wall System: Manufacturer's proprietary system. System to match and be compatible with point supported standoff system used for guardrails. Fabricate all visible components from cast, forged or machined solid stainless steel. Type 304 or 316. Finish: number 4 (220 grit) brushed.
  - .1 Top fitting: standoff fitting as specified above for guardrails.
  - .2 Glass: 17.52 mm thick, laminated, tempered glass. Type TL as specified in Section 08 81 00 - Glass Glazing. Seal joints between glass panels with Structural Silicone Glazing adhesive, TYPE B, as specified in Section 07 92 10 - Joint Sealants.
  - .3 Bottom track: U channel. Solid stainless steel fittings. 25 - 38 mm high x width as required to accommodate dry or wet glazed wall panels. Provide with matching end caps and exterior corner sections.
  - .4 Doors: unframed glass panel, 17.52 mm thick, laminated, tempered glass. Type TL as specified in Section 08 81 00 - Glass Glazing.
  - .5 Hardware: as specified in Section 08 71 00 - Door Hardware.

## 2.03 FABRICATION

- .1 Fabricate guardrail systems and wall panel systems in accordance with manufacturers written instructions.
- .2 Fabricate guardrail and wall panels system for compliance with structural requirements of applicable code.
- .3 Minimize field splicing and assembly. Provide longest lengths only as necessary for shipping and handling limitations. Mark units for field assembly and to co-ordinate installation. Use connections that maintain the structural value of the joined pieces.
- .4 Fabricate systems with minimum clearances around perimeter of assembly as recommended by manufacturer without adversely affecting the installation and normal expansion and contraction of components.
- .5 All joints to be accurately machined, fit, assembled, secured and sealed to provide tight, hairline, flush, neat joints and corners.
- .6 Prepare components to receive anchor devices. Install anchors.
- .7 Arrange fasteners and attachments to ensure concealment from view.
- .8 Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- .9 Machine joint edges smooth and plane to produce hairline seams when site assembled; supply concealed sleeve connectors for joints.

## PART 3 Execution

### 3.01 MANUFACTURERS INSTRUCTIONS

- .1 Comply with manufacturer's written recommendations and specifications, including product technical bulletins, handling, storage, and installation instructions.
- .2 Install guardrails in accordance with approved shop drawings.



- .3 Erect work plumb, square and level, free from distortion or defects detrimental to appearance or performance.

### **3.02 PREPARATION**

- .1 Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchors, sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete as masonry construction.

### **3.03 INSTALLATION STANDOFF SYSTEM**

- .1 Verify dimensions, tolerances, and method of attachment with other work on site.
- .2 Locate attachment points for standoffs to a tolerance of 1.0 mm. Install all bushings, spacers, bearing pads and other components as indicated in the shop drawings.
- .3 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

### **3.04 BASE MOULDING SYSTEM**

- .1 Install base moulding to achieve solid attachment to structure.
- .2 Permanently fasten system to building structure. Align assembly and install plumb and level, square, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .3 Install setting blocks, gaskets glass panels and mortar in accordance with manufacturer's instructions.
- .4 Caulk top edge of base moulding.

### **3.05 WALL PANEL SYSTEM**

- .1 Install wall panels below Standoff system to extend glass panels to floor below and as indicated. Attach base moulding to achieve solid attachment to floor structure.
- .2 Permanently fasten system to building structure. Align assembly and install plumb, square, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .3 Install setting blocks, gaskets glass panels and mortar in accordance with manufacturer's instructions.
- .4 Caulk top edge of base moulding.
- .5 Install swinging doors and hardware into system and adjust for proper operation.

### **3.06 SITE TOLERANCES**

- .1 Maximum variation from plumb: 1.5 mm.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.
- .3 Maximum offset from true alignment for every 50 foot length of guardrail: 6 mm, non cumulative.

### **3.07 CLEANING**

- .1 Remove protective material from prefinished surfaces.
- .2 Clean components in accordance with manufacturer's written instruction. Clean aluminum and stainless steel with a damp rag and an approved non-abrasive cleaner.

- .3 Remove dirt from corners. Wipe surfaces clean. Remove excess glazing sealant compounds by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.
- .4 Clean glass and glazing materials with an approved non-abrasive cleaner as recommended by manufacturer.

**3.08 PROTECTION**

- .1 Protect completed work for the remainder of the construction period to prevent any damage or deterioration.
- .2 Repair damaged components in accordance with manufacturer's recommendations. Replace damaged components that cannot be repaired to approval of Consultant.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 52 00 - Modified Bituminous Membrane Roofing.
- .2 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .3 Section 09 22 16 - Non-Structural Metal Framing.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A153/A153M-09. Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .2 ASTM A653/A653M-11. Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 CSA Group.
  - .1 CSA-B111-1974(R2003) Wire Nails, Spikes and Staples.
  - .2 CSA O112 Series-M1977(R2006). CSA Standards for Wood Adhesives.
  - .3 CAN/CSA O80 SERIES-08 (R2012). CONSOLIDATED - Wood Preservation.
  - .4 CAN/CSA-O141-05(R2009), Softwood Lumber.
  - .5 CSA-O151-09 (R2014). Canadian softwood plywood.
  - .6 CAN/CSA-Z809-[08], Sustainable Forest Management.
- .3 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2014.
- .4 Forest Stewardship Council (FSC).
  - .1 FSC Accredited Certified Bodies.

**1.03 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood by grade stamps in accordance with CSA O151.
- .3 Submit the Treating Plant's Certificate of Compliance from the manufacturer of all pressure treated lumber and plywood materials.

**1.04 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories. Include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals: Provide LEED submittals in accordance with Section 01 35 21 - LEED Requirements.
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

- .2 Submit calculations on end of project recycling rates, salvage rates, and landfill rates demonstrating that 75 % of construction wastes were recycled or salvaged.
- .2 Regional Materials: submit evidence that project incorporates required percentage [10] [20]% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
- .3 Wood Certification: submit manufacturer's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC certified wood.
- .4 Low Emitting Materials: Submit listing of adhesives and sealants, paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

#### **1.05 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood and wood based composite panels in accordance with CSA and ANSI standards.
- .3 Sustainable Standards Certification. For Certified Wood, submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Protect materials from the weather. Protect against exposure to rain, water, dirt, mud, and other residue that may affect performance. Cover with breathable protective wraps. Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well ventilated area.

#### **1.07 WASTE MANAGEMENT AND DISPOSAL**

- .1 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 21 - LEED Requirements.
- .2 Remove for reuse and return to manufacturer all pallets, crates, padding and packaging materials as specified in Section 01 74 21 - Construction / Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.
- .3 Separate and recycle waste materials. Separate wood waste and place in designated areas in the following categories for recycling: Solid wood / softwood / hardwood, treated, painted, or contaminated wood, sheet materials, off-cuts.
- .4 Separate metal, plastic, wood and corrugated cardboard packaging. Fold up metal banding, flatten, and place in designated area for recycling.
- .5 Do not burn scrap at the project site.

### **Part 2 Products**

#### **2.01 MATERIALS**

- .1 Sustainability Characteristics: Lumber and plywood: to CAN/CSA-Z809 or FSC certified.

## 2.02 LUMBER

- .1 Exterior furring, blocking, nailing strips, rough bucks, cants, curbs, fascia backing and sleepers.
  - .1 Preservative Treated Lumber: Board and timber sizes. SPF, S4S, Pressure treated lumber to CSA O80.20. Use Category 3.2. Following treatment, kiln-dry material to maximum moisture content of 19%.
    - .1 Produced with a formulation free of halogens, sulfates, chlorides and ammonium phosphate. Each piece of treated lumber to bear label indicating classification.
    - .2 Grade: NLGA #2 or better grade.
    - .3 Treatment: chromated copper arsenate (CCA) or ammoniacal copper arsenate (APA). Preservative rate: 6.4 kg / cubic meter.
  - .2 End cut wood preservative. Surface applied, clear or coloured. Approved by supplier of treated lumber specifically intended for application to ends of treated materials exposed by cutting.
- .2 Interior solid lumber blocking, interior furring, strapping, nailing strips, grounds and rough bucks. Grade: to CAN/CSA-O141 and NLGA Standard Grading Rules for Canadian Lumber.
  - .1 SPF, S4S. Kiln dried to moisture content 6 - 8 % or less.
  - .2 Grade: "Standard" or better grade.
  - .3 Solid lumber not built up or laminated. Free of knots or surface defects.
  - .4 Glued end-jointed (finger-jointed) lumber is not acceptable for any use.

## 2.03 SHEET PRODUCTS

- .1 Sheathing: Canadian softwood plywood (CSP): to CSA O151, veneer core plywood, sheathing grade, unsanded. Thickness as indicated in the drawings.

## 2.04 ACCESSORIES

- .1 General purpose adhesive: to CSA O112.9.
- .2 Nails, spikes and staples: to CSA B111. Hot dip galvanized.
- .3 Wood screws: size to suit or as indicated. Self tapping, large washer type pan heads screws for use with metal studs. Galvanized.
- .4 Explosive actuated fastening devices not permitted.
- .5 Bolts and lag bolts: diameter as shown. Hot dip galvanized complete with hot dip galvanized nuts and washers.
- .6 Proprietary fasteners: toggle bolts, expansion shields and lag bolts and screws: as recommended for purpose by manufacturer.
- .7 Finishes: hot dip galvanized to ASTM A123/A123M.
- .8 Fasteners for preservative treated lumber: Hot-Dipped zinc coated galvanized steel, stainless steel, silicon bronze or copper. Provide corrosion resistant fasteners as approved by lumber manufacturer. Minimum Hot Dip galvanized to ASTM A153/A153M. Hardware to ASTM A653/A653M, Class G185 galvanized.

**Part 3 Execution**

**3.01 PREPARATION**

- .1 Comply with panel manufacturer's installation instructions, CCMC reports, approved Shop Drawings and product data including Technical Bulletins and Product Information Bulletins.
- .2 Comply with requirements of NBCC (2005) Part 9.

**3.02 EXAMINATION**

- .1 Verify substrate conditions installed under other related sections are acceptable for product installation in accordance with manufacturer's instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

**3.03 PRESSURE TREATED LUMBER**

- .1 Treat surfaces exposed by cutting, trimming or boring with liberal brush application of wood preservative before installation.
- .2 Treat field cuts on members in accordance with manufacturer's written instructions. End cuts and drilling is permitted. Do NOT rip or otherwise mill treated lumber materials.
- .3 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
  - .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.

**3.04 INSTALLATION**

- .1 Install members true to line, levels and elevations, square and plumb.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Install furring and blocking as required to space out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding, equipment mounting boards, and other work as required.
- .4 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .5 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .6 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.
- .7 Install sleepers as indicated.
- .8 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .9 Countersink bolts where necessary to provide clearance for other work.
- .10 Install mechanical fasteners and secure members as required to obtain rigid and secure attachment. Apply continuous bead of adhesive in accordance with manufacturer's instructions where necessary and where fasteners alone are not sufficient.

**3.05 SHEATHING**

- .1 Install plywood wall sheathing in accordance with manufacturer's printed instructions. Install plywood sheathing to wall assemblies as indicated in the drawings. Install in full sized sheets to minimize joints. Install so that all edges land on solid supports.

- .2 Install plywood to steel stud framing with self tapping screws with large, washer type pan heads.

**3.06 SCHEDULE TO BE REVIEWED**

- .1 Provide Solid Blocking in stud framed walls for surface mounted equipment and accessories as specified below and as indicated. Refer to drawings for specific details relating to nailing strips and blocking to be provided in wall assemblies. Install solid blocking as specified in Section 09 22 16 - Non-Structural Metal Framing.
  - .1 Coat Closets: Provide 38 x 185 mm SPF solid blocking to support surface mounted shelf and rod assemblies. Provide continuous row of blocking around entire perimeter of closet at height to support shelf. Install blocking behind the gypsum wall board and secure between the steel studs.
  - .2 Washroom Accessories: provide 15 mm thick GIS DFP installed behind the gypsum wallboard. Install plywood blocking 1200 mm high between the steel studs. Extend plywood a minimum of 1 stud cavity each direction from indicated mounting location. Center the plywood blocking on the centre line of mounting bracket. Refer to drawings for locations and mounting heights. Provide in all washroom where there are any surface mounted washroom equipment or accessories indicated.
  - .3 Bulletin Boards / White Boards: Provide 38 x 185 mm SPF blocking to support surface mounted bulletin boards and white boards. Provide continuous row of blocking where bulletin boards or white boards are indicated along top and bottom edges at heights as indicated in the drawings. Install blocking behind the gypsum wall board and secure between the steel studs. Refer to drawings for locations and mounting heights.
  - .4 Electrical equipment: Provide equipment backboards for all surface mounted electrical, telecommunication and security equipment. Provide layer of 19 mm thick, GIS DFP plywood. Extend layer of plywood from floor to ceiling and install over top of the finished surface. Extend plywood full width of the wall on which it occurs. Provide 19 x 38 mm strapping to support backboard from face of wall. Install strapping continuously around perimeter and at maximum 300 mm OCV intermediate. Refer to electrical drawings for locations.
  - .5 Handrails: Install continuous strip of 15 mm thick GIS DFP blocking behind the gypsum wallboard. Install plywood blocking between the steel studs and secure through web members from both ends. Install 600 mm wide strip of plywood blocking centered at the height of mounting brackets for the handrails. Refer to drawings for locations and mounting heights. Blocking to be continuous for entire length of walls where hand rails are located.

**3.07 CLEANING**

- .1 Conduct regular progress cleaning in accordance with Section 01 74 11 - Cleaning. Leave Work area clean at end of each day.
- .2 Upon completion remove surplus materials, rubbish, tools and equipment.

**3.08 PROTECTION**

- .1 Protect completed installation from weather with temporary protection.
- .2 Protect installed work from exposure and damage during construction. After installation is complete, cover to prevent contact with water on all exposed edges and faces.
- .3 Repair damage to adjacent materials caused by rough carpentry installation.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 03 30 00 - Cast-In-Place Concrete.
- .2 Section 07 21 13 - Board Insulation.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM D4479/D4479M-07(2012)e1. Standard Specification for Asphalt Roof Coatings - Asbestos-Free.
- .2 Canada Green Building Council (CaGBC).
  - .1 LEED Canada Reference Guide for Green Building and Construction. 2009.

**1.03 PRODUCT DATA**

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature and datasheets. Include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide Manufacturers installation instructions to indicate special handling criteria, installation sequence and cleaning procedures.
- .4 Submit 2 copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29 - Health and Safety Requirements.
- .5 Submit Sustainable Design Submittals in accordance with Section 01 35 21 - LEED Requirements.
  - .1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements. Submit calculations on end of project recycling rates, salvage rates, and landfill rates demonstrating that specified rate of construction wastes were recycled or salvaged.
  - .2 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, post-industrial content, and total cost of materials for project.
  - .3 Submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .4 Submit listing of coatings and sealers used, showing compliance with VOC and chemical component limits or restriction requirements.

**1.04 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Store materials in accordance with manufacturer's written instructions.
- .3 Provide and maintain dry, off-ground weatherproof storage. Provide clean, dry area. Store materials on supports to prevent deformation. Ventilate enclosed storage spaces.



- .4 Do not store at temperatures above 32 degrees C for extended periods. Keep away from sparks and flames.
- .5 Protect materials from nicks, scratches, and blemishes. Replace defective or damaged materials with new.
- .6 Remove only in quantities required for same day use.

#### **1.05 WASTE MANAGEMENT AND DISPOSAL**

- .1 Develop Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 35 21 - LEED Requirements.
- .2 Packaging Waste Management: remove for reuse and return pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan and Waste Reduction Workplan. Remove from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.
- .3 Fold up metal banding, flatten and place in designated area for recycling.
- .4 Divert unused bituminous dampproofing, sealing compounds and asphalt primer materials from landfill to recycling facility approved by Departmental Representative.

#### **1.06 PROJECT/SITE ENVIRONMENTAL REQUIREMENTS**

- .1 Ambient conditions, temperature, relative humidity, moisture content:
  - .1 Apply dampproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
  - .2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place. Do not apply to frozen concrete.
  - .3 Maintain air temperature and substrate temperature at installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.
  - .4 Do not apply dampproofing in wet weather.
- .2 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

### **Part 2 Products**

#### **2.01 MATERIALS**

- .1 Spray applied, solvent type dampproofing. To ASTM D 4479, Type 1, asbestos free, non fibered asphalt compound. Membrane will withstand temperature changes and will not crack under normal expansion and contraction. Application rates as follows:
  - .1 Primer coat: approximately 70-100 square feet per gallon. (1.71 to 2.45 square meters pre litre.
  - .2 Dampproofing coat: apply at 1/16 inch wet film thickness: Coverage approximately 20 - 25 square feet per gallon. (0.5 to 0.6 square meters per litre.
- .2 Sealing compound: same compound as used for dampproofing but provided in a heavy bodied, fibrated, trowel grade formulation.
- .3 Drainage board/ Goetextile fabric board: vertical drainage / fabric protection system. High strength geo-composite drainage board: dimple raised, high strength, molded polystyrene core bonded to a high strength, non woven, polypropylene geotextile fabric. High flow capacity

without clogging, high compressive strength. Overall thickness 11.1 mm. Roll size: 1.200 wide x 15.2 M long.

- .1 Core properties as follows:
  - .1 Compressive strength: 718 kpa.
  - .2 Flow rate: litres per minute per square metre at HG=1.0. 211.
- .2 Fabric properties as follows:
  - .1 Grab tensile strength: 445N.
  - .2 Puncture resistance: 289 N.
  - .3 Apparent opening size: 0.21 mm.
  - .4 Water flow rate: litres per minute per square metre: 6724.
  - .5 Grab elongation (%): 65.
  - .6 UV Resistance: % at 500 hours: 70.
- .3 Termination bar: matching bar by manufacturer of the drainage board.
- .4 Fasteners: compatible fasteners by manufacturer of the drainage board.
- .5 Mastic: by manufacturer of the drainage board.
- .4 Insulation: rigid board foundation insulation as specified in Section 07 21 13 - Board Insulation.

### **Part 3 Execution**

#### **3.01 EXAMINATION**

- .1 Verify that conditions of substrate previously installed are acceptable for application of dampproofing in accordance with manufacturer's written instructions.
- .2 Visually inspect substrate. Inform Consultant of unacceptable conditions immediately upon discovery. Proceed with installation only after unacceptable conditions have been remedied.

#### **3.02 WORKMANSHIP**

- .1 Keep products within the recommended temperature range at place of application.
- .2 Apply dampproofing in accordance with manufacturer's instructions.

#### **3.03 PREPARATION**

- .1 Protect adjacent surfaces not designated to receive dampproofing.
- .2 Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- .3 Surfaces must be clean, smooth and free of standing water. Patch all holes and voids and smooth out any surface misalignments.
- .4 Before applying dampproofing, seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations with sealing compound. Do sealing work in accordance with manufacturer's instructions.

#### **3.04 APPLICATION DAMPPROOFING**

- .1 Mix dampproofing and thoroughly stir in original containers prior to applications.
- .2 Apply primer coat to all surfaces at specified rate in accordance with manufacturer's instructions.

- .3 Apply dampproofing at specified rate in a continuous, unbroken film, free of pinholes, filling and spreading around all joints, slots and grooves and penetrating into all crevices, chases, reveals, soffits, and corners.
- .4 Carry coating over the exposed footing's top and outside edge up to finished grade.

### 3.05 FOUNDATION INSULATION

- .1 Where indicated in the drawings apply layer of rigid board insulation to face of foundation wall.

### 3.06 DRAINAGE BOARD / GEOTEXTILE FABRIC BOARD

- .1 Vertical Application:
  - .1 Unroll drainage board with flat, core side placed against the insulation. Where there is no insulation, apply drainage board directly to the bituminous dampproofing membrane. Fasten drainage board at the top edge with a suitable mechanical fastening system that is compatible with the substrate.
  - .2 Adhere remainder of drainage board with mastic.
  - .3 Overlap the flat side core lip with second sheet of drainage board to provide a continuous drainage layer (shingle fashion). Ensure excess filter fabric is overlapped with this next sheet.
- .2 Backfill immediately using care to avoid damaging drainage layer and to ensure permanent placement of the drainage board.

### 3.07 SCHEDULE

- .1 Apply continuous, uniform coating to entire exterior face of walls from 50 mm below finished grade level to and including tops of foundation wall footings. Apply continuous, uniform coating to exterior side of foundation walls below finished grade.
- .2 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 230 mm along pipes passing through walls.

### 3.08 CLEANING

- .1 Conduct daily cleaning in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Upon completion remove surplus materials, rubbish, tools and equipment.
- .4 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.09 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dampproofing application.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 21 16 - Blanket Insulation.
- .2 Section 07 52 00 - Modified Bituminous Roofing.
- .3 Section 07 53 23 - EPDM Conventional Roofing and Waterproofing.
- .4 Section 08 44 13 - Glazed Aluminum Curtain Walls.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C165-07(2012). Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
  - .2 ASTM C203-05a(2012). Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
  - .3 ASTM C356-10. Standard Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat.
  - .4 ASTM C518-15. Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - .5 ASTM C612-14. Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .6 ASTM C1104/C1104M-13a. Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
  - .7 ASTM C1289-16. Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
  - .8 ASTM D1621-16. Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - .9 ASTM D1622/D1622M-14. Standard Test Method for Apparent Density of Rigid Cellular Plastics.
  - .10 ASTM D1623-09. Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
  - .11 ASTM D2842-12. Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- .2 Underwriters Laboratories of Canada (ULC).
  - .1 CAN/ULC-S102-2010. Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S114-05. Standard Method of Test for Determination of Non-Combustibility in Building Materials.
  - .3 CAN/ULC-S701-11. Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .4 CAN/ULC-S704-11. Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
  - .5 CAN/ULC-S770-15. Standard Test Method For Determination Of Long Term Thermal Resistance Of Closed Cell Thermal Insulating Foams.

**1.03 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, specifications and data sheet for insulation products. Submit manufacturer's installation instructions.
- .3 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's insulation products and adhesives.
- .4 Provide documentation in accordance with Section 01 35 21 - LEED Requirements. Submit verification requirements for specified items as follows:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Low-emitting materials.
  - .6 EA Credit 1: Thermal value of insulation contributing to overall energy performance of building.
  - .7 MR Credits 4: Recycled content of insulation indicating percentages by weight of preconsumer and postconsumer recycled content.
  - .8 MR Credits 5: Verify location where insulation is extracted, processed and manufactured.

**1.04 QUALITY ASSURANCE**

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

**1.05 DELIVERY STORAGE AND HANDLING**

- .1 Deliver material in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials and accessories in insulation manufacture's original packaging with identification labels intact and in sizes to suit project.
- .3 Ensure insulation materials are not exposed to moisture during delivery. Replace wet or damaged insulation materials.
- .4 Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer. Store in original packaging until installed.

**1.06 WASTE MANAGEMENT**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate all paper, plastic, polystyrene and corrugated cardboard packaging material in accordance with Waste Management Plan.

**Part 2 Products**

**2.01 INSULATION**

- .1 Extruded polystyrene (XPS): to CAN/ULC-S701. Type 4. For application to VERTICAL (wall) surfaces.
  - .1 Thermal resistance per 25 mm: to ASTM C518 at 24 degrees C: R 5.0, RSI 0.88.
  - .2 Compressive strength: to ASTM D1621. PSI: 30, kPa: 207.
  - .3 Water absorption: to ASTM D2842. By volume: Max 0.7 %.
  - .4 Maximum use temperature: 74 degrees C.
  - .5 Thickness: as indicated in the drawings.
  - .6 Size: 610 x 2440 mm.
  - .7 Edges: shiplapped.
- .2 Extruded polystyrene (XPS): to CAN/ULC-S701. Type 4. For application to HORIZONTAL (roof) surfaces.
  - .1 Thermal resistance per 25 mm: to ASTM C518 at 24 degrees C: R 5.0, RSI 0.88.
  - .2 Compressive strength: to ASTM D1621. PSI: 35, kPa: 240.
  - .3 Flexural strength: to ASTM C203. Minimum 50 psi, 350 kPa.
  - .4 Water absorption: to ASTM D2842. By volume: Max 0.7 %.
  - .5 Maximum use temperature: 74 degrees C.
  - .6 Thickness: as indicated in the drawings.
  - .7 Size: 610 x 1220 mm.
  - .8 Edges: shiplapped.
- .3 Semi-Rigid Mineral Fibre Board: commercial multi purpose board. Unfaced, non combustible, insulation board to ASTM C612. Type IVB.
  - .1 Density: to ASTM C612. 96 kg per cubic metre. 6.0 pounds per cubic foot.
  - .2 Thermal resistance: to ASTM C518. RSI 0.74 (R4.2 )per 25 mm at 24 degrees C.
  - .3 Compressive strength: to ASTM C165. 17 kPa at 10% compression.
  - .4 Fire performance: non-combustibility to CAN/ULC S114.
  - .5 Surface burning characteristics: to CAN/ULC S102. Flame spread 5. Smoke developed: 10.
  - .6 Water vapour permeance: maximum 1715 ng per Pa per second per square metre.
  - .7 Moisture sorption: to ASTM C1104/C1104M. 0.07 %.
  - .8 Dimensional stability: to ASTM C356. Maximum 0.47 % shrinkage at 650 degrees C.
  - .9 Thickness: as indicated.
  - .10 Sizes: 610 x 1220 mm.
- .4 Polyisocyanurate Insulation (faced): to ASTM C1289, Type II, Class 2, Grade 2 (20 psi) and CAN/ULC-S704 Type II (20 psi)
  - .1 Closed cell HCFC free insulation.
  - .2 Thermal resistance: LTTR to CAN/ULC-S704 and CAN/ULC-S770. RSI 1.004, R 5.7 at 25 mm thickness.
  - .3 Facing: factory applied polymer coated inorganic glass fibre facing on both sides.
  - .4 Compressive strength: to ASTM D1621: 20 psi, 138 kPa.
  - .5 Density: to ASTM D1622: 32 kg per cubic metre, 2.0 pounds per cubic foot.

- .6 Tensile strength: to ASTM D1623: 35 kPa, 730 pounds per square foot.
- .7 Board size: 1220 x 2440 mm.
- .8 Thickness: 75 mm. Provide in 2 separate layers.
- .9 Shape: flat. Edges: square.

## **2.02 ACCESSORIES**

- .1 Adhesive: all purpose construction adhesive type recommended by board manufacturer. Low VOC type.
- .2 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

## **Part 3 Execution**

### **3.01 MANUFACTURER'S INSTRUCTIONS**

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

### **3.02 EXAMINATION**

- .1 Visually inspect substrate. Examine substrates and notify Consultant in writing of defects.
- .2 Prior to commencement of work ensure substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.
- .3 Verify that conditions of substrate are acceptable for insulation installation in accordance with manufacturer's written recommendations.
- .4 Proceed with installation only after unacceptable conditions have been remedied. Start of insulation installation indicates installer's acceptance of substrate installation conditions.

### **3.03 WORKMANSHIP**

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain thermal protection continuity of building elements & spaces. Fit insulation tight around penetrations and protrusions through the structure.
- .3 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .4 Do not enclose insulation until it has been approved by Consultant.

### **3.04 BELOW GRADE INSULATION**

- .1 Apply adhesive to insulation board in accordance with manufacturer's recommendations.
- .2 Leave insulation board joints un-bonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

### **3.05 EXTERIOR WALL INSULATION**

- .1 Install single layer or multiple layers of insulation boards continuously at perimeter walls as indicated.

**3.06 ROOF INSULATION**

- .1 Install single layer or multiple layers of insulation boards continuously as indicated in the drawings.
- .2 Install two separate layers of insulation boards continuously across roof area as indicated in the drawings.
- .3 install with joints tight to each other and tight to penetrations. Offset joints in both directions between each layer.
- .4 Fill gaps at penetrations and at perimeter to completely seal insulation to fixed objects as indicated.

**3.07 CAVITY WALL INSTALLATION**

- .1 Install insulation boards on outer surface of wall sheathing.

**3.08 CURTAIN WALL INSULATION**

- .1 Install insulation boards into Curtain wall assembly as indicated. Secure with insulation clips to structure as detailed.

**3.09 CLEANING**

- .1 Perform cleanup as work progresses in accordance with Section 01 74 00 - Cleaning. Leave work area clean at end of each day.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .3 Collect recyclable waste and dispose of or recycle field generated construction waste. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.010 PROTECTION**

- .1 Protect installed products and accessories from damage during construction.
- .2 Repair damage to adjacent materials caused by insulation installation.

**END OF SECTION**



**Part 1 General**

**1.01 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C303-10. Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
  - .2 ASTM C423-09a. Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - .3 ASTM C553-13. Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .4 ASTM C1320-10(2016). Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2 Canada Green Building Council (CaGBC).
  - .1 LEED Canada Reference Guide for Green Building and Construction. 2009.
- .3 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN/ULC-S102-10. Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S114-05. Standard Method of Test for Determination of Non-Combustibility in Building Materials.
  - .3 CAN/ULC-S129-15. Standard Method of Test for Smoulder Resistance of Insulation (Basket Method).
  - .4 CAN/ULC-S702.1:2014-AMD1. Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

**1.02 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, specifications and data sheet. Submit manufacturer's installation instructions.
- .3 Submit evaluation service reports from independent testing agency showing compliance with specified performance characteristics and physical properties.
- .4 Submit LEED documentation in accordance with Section 01 35 21 – LEED Requirements.
  - .1 Submit verification for items as follow:
    - .1 EA Credit 1: Thermal value of insulation contributing to overall energy performance of building.
    - .2 MR Credits 4: Recycled content of insulation indicating percentages by weight of preconsumer and postconsumer recycled content.
    - .3 MR Credits 5: Verify location where insulation is extracted, processed and manufactured.
  - .2 Submit Sustainable Design Closeout Documentation as follows:
    - .1 Provide calculations on end-of-project recycling rates, salvage rates, and landfill rates for work of this Section demonstrating percentage of construction wastes which were recycled.
    - .2 Submit verification from recycling facility showing receipt of materials.

**1.03 QUALITY ASSURANCE**

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

**1.04 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic and corrugated cardboard packaging material in appropriate on-site containers for recycling in accordance with Waste Management Plan.

**1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver material in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials and accessories in insulation manufacture's original packaging with identification labels intact and in sizes to suit project.
- .3 Ensure insulation materials are not exposed to moisture during delivery. Replace wet or damaged insulation materials.
- .4 Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer. Store in original packaging until installed.

**Part 2 Products**

**2.01 INSULATION**

- .1 Sound Attenuation batt insulation. Mineral wool, non-combustible, flexible, industrial, blanket insulation. Water repellent, fire resistant and sound absorbent, lightweight, semi-rigid, stone wool batt insulation. Properties as follows:
  - .1 Type: 1. To ASTM C553 and CAN/ULC-S702.1.
  - .2 Density: to ASTM C303. 45 kg per cubic meter.
  - .3 Thickness: 25 and 38 mm as indicated in the drawings.
  - .4 Fire performance: non-combustible to CAN/ULC-S114.
  - .5 Surface Burning Characteristics: to CAN/ULC-S102. Flame spread: 0. Smoke developed: 0.
  - .6 Smoulder resistance: to CAN/ULC-S129. 0.09%.
  - .7 Acoustical Performance: Sound absorption co-efficient: to ASTM C423.

| Thickness<br>(mm) | 125<br>Hz | 250 Hz | 500<br>Hz | 1000<br>Hz | 2000 Hz | 4000 Hz | NRC  |
|-------------------|-----------|--------|-----------|------------|---------|---------|------|
| 25                | 0.14      | 0.25   | 0.65      | 0.90       | 1.01    | 1.01    | 0.70 |
| 38                | 0.18      | 0.44   | 0.94      | 1.04       | 1.02    | 1.03    | 0.85 |
| 50                | 0.28      | 0.60   | 1.09      | 1.09       | 1.05    | 1.07    | 0.95 |
| 76                | 0.52      | 0.96   | 1.18      | 1.07       | 1.05    | 1.05    | 1.05 |
| 102               | 0.86      | 1.11   | 1.20      | 1.07       | 1.08    | 1.07    | 1.10 |

**2.02 ACCESSORIES**

- .1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.
- .2 Retention wires: rigid wires placed horizontally specifically intended by the manufacturer to suit stud spacing to hold blanket insulation in place.

**Part 3 Execution**

**3.01 MANUFACTURER'S INSTRUCTIONS**

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

**3.02 INSULATION INSTALLATION**

- .1 Verify that conditions of substrate previously installed under other Sections are acceptable for insulation installation in accordance with manufacturer's written recommendations.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Ensure surfaces are free of snow, ice, frost, grease and other deleterious materials.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- .2 Start of insulation installation indicates installer's acceptance of substrate installation conditions.
- .3 Install insulation to maintain continuity of thermal protection to building elements and spaces. Install in accordance with ASTM C1320.
- .4 Retain insulation in position within stud cavity insulation clips installed as recommended by manufacturer.
- .5 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .6 Co-ordinate installation of firestopping insulation with Section 07 84 00 - Firestopping.
- .7 Do not compress insulation to fit into spaces.
- .8 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of insulated chimneys and vents.
- .9 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealing.
- .2 Section 08 44 13 - Glazed Aluminum Curtain Walls.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM C1029-15. Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
- .2 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN/ULC-S101-14. Standard Method of Fire Endurance Tests of Building Construction and Materials.
  - .2 CAN/ULC-S102-10. Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.
  - .3 CAN/ULC-S705.1-15. Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification.
  - .4 CAN/ULC-S705.2:2005-R2016. Standard for Thermal Insulation Spray Applied Rigid Polyurethane Foam, Medium Density - Application.

**1.03 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature and data sheets for sprayed insulation. Include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit 2 copies of WHMIS MSDS.
- .4 Provide the CCMC Evaluation Report and the manufacturer's documentation confirming material has been evaluated and conforms to the requirements of CAN/ULC-S705.1.
- .5 Submit evaluation report or listing from a recognized evaluation service.
- .6 Submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .7 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
- .8 Submit manufacturer's installation instructions. Indicate preparation, installation sequencing, installation requirements and techniques. Indicate product storage and special handling criteria. Indicate limitations of the material and cleaning procedures.
- .9 Submit Sustainable Design Submittals for LEED in accordance with Section 01 35 21 - LEED Requirements.
  - .1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.
  - .2 Submit calculations on end of project recycling rates, salvage rates, and landfill rates demonstrating that the specified rate of construction wastes were recycled or salvaged.

- .3 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
- .4 Submit evidence that project incorporates required percentage of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

**1.04 QUALITY ASSURANCE**

- .1 Manufacturer: company with experience in producing material required for this project, with sufficient production capacity to produce and deliver required units without causing delay.
- .2 Applicators performing work under this section to be trained under the manufacturer's quality assurance program. Applicators to be trained by the manufacturer and licensed by a recognized certification service.

**1.05 MOCK-UP**

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock-up 10.0 square meters minimum of foamed in place polyurethane insulation. Include one inside corner, one outside corner. Include the complete perimeter of a door or window opening. When approved, Mock-up may be part of finished work.
- .3 Allow 24 hours for inspection of mock-up by Consultant before proceeding.

**1.06 SAFETY REQUIREMENTS**

- .1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations.
  - .1 Workers must wear gloves, respirators, dust masks, long sleeved clothing, eye protection and protective clothing when applying foam insulation.
  - .2 Workers must not eat, drink or smoke while applying foam insulation.

**1.07 DELIVERY STORAGE AND PROTECTION**

- .1 Deliver store and protect all materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Store materials off ground, indoors, in dry location in clean, dry, well ventilated area.
- .4 Store and protect materials from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

**1.08 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management And Disposal.
- .2 Develop Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 35 21 - LEED Requirements.
- .3 Remove for reuse and return to manufacturer, all pallets, crates, padding, and packaging materials.

- .4 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Dispose of waste foam daily in location designated by Consultant
- .7 and decontaminate empty drums in accordance with foam manufacturer's instructions.
- .8 Divert metal drums from landfill to metal recycling facility as approved by Consultant

## 1.09 SITE CONDITIONS

- .1 Ventilate area in accordance with Section 01 51 00 - Temporary Utilities.
- .2 Ventilate area by introducing fresh air and exhausting air continuously during and 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.
- .3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .5 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

## Part 2 Products

### 2.01 MATERIALS

- .1 Insulation: to ASTM C1029 and CAN/ULC-S705.1, Type 2, two component, closed cell, spray applied rigid polyurethane foam. Medium density. Zero ozone depletion blowing agent.
  - .1 Core density: minimum 40 kg/m<sup>3</sup>. (2.5 pcf).
  - .2 Compressive strength: minimum 207 kPa. (30psi).
  - .3 Tensile strength: 414 kPa. (60 psi).
  - .4 Water absorption: less than 2 % by volume.
  - .5 Dimensional stability: aged 28 days at 70°C at 97±3% RH: less than 9.0 % by volume.
  - .6 Long term thermal resistance: minimum RSI 0.9 per 25 mm.
  - .7 Water vapor permeance @ 50 mm thickness: less than 60 ng/Pa x second x square meter.
  - .8 Specific gravity: 1.14 - 1.23.
  - .9 Maximum thickness per pass: 50 mm.
- .2 Primers: in accordance with manufacturer's recommendations for surface conditions.
- .3 Accessories: air / vapour barrier membranes, mastics, sealants, liquids complete with required primers to complete the transitions for the air barrier system.

### 2.02 EQUIPMENT

- .1 Provide spray equipment in accordance with CAN/ULC-S705.2 and the equipment manufacturer's recommendations for specific type of application.
- .2 Record equipment settings on the Daily Work Record as required by CAN/ULC- S705.2.
- .3 Each proportioner unit to supply only one spray gun.

**Part 3 Execution**

**3.01 EXAMINATION**

- .1 Verify that conditions of substrate are acceptable for sprayed insulation application accordance with manufacturer's written instructions.
- .2 Visually inspect substrate in presence of Consultant. Prior to commencement of work, report in writing any defects or conditions that may adversely affect the performance of products installed under this section.
- .3 Proceed with installation only after unacceptable conditions have been remedied. Commencement of work outlined in this section shall be deemed as acceptance of existing work and conditions.

**3.02 PROTECTION**

- .1 Mask and cover adjacent areas to protect from over spray.
- .2 Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.
- .3 Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air.
- .4 Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.

**3.03 SURFACE PREPARATION**

- .1 Surfaces to receive foam insulation shall be free of oil, grease, dust and debris. Surfaces to be clean, dry and properly fastened to ensure adhesion of the foam to the substrate.
- .2 Ensure that all work by other trades that may penetrates through the thermal insulation is in place and complete.
- .3 Ensure that surface preparation and any primers required conform to the manufacturers instructions.

**3.04 APPLICATION**

- .1 Clean areas to receive insulation and apply primer. Apply primer in accordance with manufacturer's instructions.
- .2 Apply foam insulation to primed surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions.
- .3 Spray apply foam insulation in thickness as indicated in the drawings.
- .4 Spray-application of foam shall be performed in accordance with CAN/ULC-S705.2 and the manufacturers instructions.
- .5 Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer and CAN/ULC-S705.2.
- .6 Apply in consecutive passes as recommended by manufacturer to thickness as indicated on drawings. Passes shall be not less than 15 mm and not greater than 50 mm.
- .7 Do not install spray foam within 75 mm of heat emitting devices such as light fixtures and chimneys.
- .8 Finished surface of foam insulation to be free of voids and imbedded foreign objects.

- .9 Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
- .10 Trim, as required, any excess thickness that would interfere with the application of cladding system by other trades.

**3.05 TOLERANCES**

- .1 Maximum variation from indicated thickness: minus (-) 6 mm. plus (+) 10 mm.

**3.06 CLEANING**

- .1 Conduct daily cleaning in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Upon completion, remove surplus materials, rubbish, tools and equipment. Remove insulation material spilled during installation and leave work area ready for application of wall board.
- .4 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.07 PROTECTION**

- .1 Protect the spray foam from ultraviolet as per manufacturer's requirements.
- .2 Cover the spray foam with an appropriate thermal barrier as detailed.

**3.08 SCHEDULE.**

- .1 Apply foam to surfaces of cleaned and prepared surfaces as indicated in the drawings.
- .2 Apply foam so that finished face is vertical, plumb flat and in a straight plane.

**END OF SECTION**



**Part 1 General**

**1.01 REFERENCES**

- .1 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-51.34-M86(1988). Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

**1.02 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria and limitations.
- .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
- .4 Provide certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Submit manufacturer's installation instructions.
- .6 Submit proof of manufacturer's CCMC Listing and listing number to Consultant.

**1.03 MOCK-UPS**

- .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control. Locate where directed by Consultant.
- .2 Construct mock-up of sheet vapour barrier installation including one lap joint and one inside corner. When approved, Mock-up may be part of finished work.
- .3 Mock-up will be used to judge workmanship, substrate preparation, and material application. When accepted, mock-up will demonstrate minimum standard of quality required for this work.
- .4 Allow 24 hours for inspection of mock-up by Consultant before proceeding with vapour barrier work.

**1.04 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with the Waste Reduction Workplan specified in Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .2 Place used hazardous sealant tubes and adhesive containers in areas designated for hazardous materials. Place materials defined as hazardous or toxic waste in designated containers.

**Part 2 Products**

**2.01 SHEET VAPOUR BARRIER**

- .1 Polyethylene film: to CAN/CGSB-51.34. Thickness: 10 mil.

**2.02 ACCESSORIES**

- .1 Joint sealing tape: air resistant adhesive tape. Type recommended by vapour barrier manufacturer. Minimum 50 mm wide. Bright red.

- .2 Sealant: acoustic sealant as specified in Section 07 92 10 - Joint Sealants.
- .3 Fasteners: self tapping sheet metal screws with large, washer size pan heads.
- .4 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

### **Part 3 Execution**

#### **3.01 INSTALLATION**

- .1 Ensure services are installed and inspected prior to installation of vapour barrier.
- .2 Install sheet vapour barrier on warm side of exterior walls, ceilings and floor assemblies prior to installation of gypsum board to form continuous barrier.
- .3 Install sheet vapour barrier on interior walls in locations as indicated.
- .4 Use sheets of largest practical size to minimize joints.
- .5 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.
- .6 Cut sheet vapour barrier to form openings. Ensure material is lapped and sealed to perimeter of all openings.

#### **3.02 PERIMETER SEALS**

- .1 Seal perimeter of sheet vapour barrier as follows:
  - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
  - .2 Lap sheet over sealant and press into sealant bead.
  - .3 Install self tapping, flat pan head steel screws with integral washers into steel studs. Install self drilling screws with oversized heads and washers to masonry or concrete substrates.
  - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

#### **3.03 LAP JOINT SEALS**

- .1 Seal lap joints of sheet vapour barrier as follows:
  - .1 Attach first sheet to substrate.
  - .2 Apply continuous bead of sealant over solid backing at joint.
  - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
  - .4 Install self tapping, flat pan head steel screws with integral washers through lapped sheets at sealant bead into steel studs. Install self drilling screws with oversized heads and washers to masonry or concrete substrates.
  - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

#### **3.04 ELECTRICAL BOXES**

- .1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
  - .1 Install moulded box vapour barrier.
  - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

**3.05            CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM D412-15a. Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .2 ASTM D882-12. Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
  - .3 ASTM E96/E96M-16. Standard Test Methods for Water Vapor Transmission of Materials.
  - .4 ASTM E154/E154M-08a(2013)e1. Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
  - .5 ASTM E283-04(2012). Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .2 National Air Barrier Association (NABA). Professional Contractor Quality Assurance Program.

**1.03 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit manufacturer's complete installation instructions.

**1.04 QUALITY ASSURANCE**

- .1 Perform Work in accordance with NABA Professional Contractor Quality Assurance Program.
- .2 Maintain one copy of documents on site.
- .3 Convene pre work conference one week prior to commencing Work of this section.

**1.05 QUALIFICATIONS**

- .1 Applicator: Company specializing in performing work of this section with minimum 5 years documented experience with installation of air barrier system. Completed installation must be approved by the material manufacturer.
- .2 Applicator: Company who is currently licensed by NABA or certifying organization must maintain their license throughout the duration of the project.

**1.06 MOCK-UP**

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct typical exterior wall panel, 1200 mm wide by full height, incorporating window and door frame including sill and insulation. Include building corner condition, junction with roof system. Illustrate material interface and seals.

- .3 Locate where directed by Consultant. Allow 24 hours for inspection of mock-up by Consultant before proceeding with air barrier Work.
- .4 Approved Mock-up may remain as part of the Work.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Avoid spillage. Immediately notify Consultant if spillage occurs and start clean up procedures. Clean spills and leave area as it was prior to spill.

#### **1.08 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with the Waste Reduction Workplan as specified in Section 01 74 21 - Construction / Demolition Waste Management.
- .2 Place materials defined as hazardous or toxic waste in designated containers. Ensure emptied containers are sealed and stored safely for disposal away from children.

#### **1.09 PROJECT ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

### **Part 2 Products**

#### **2.01 SHEET MATERIALS**

- .1 Sheet Seal: self adhering membrane consisting of an SBS rubberized asphalt compound integrally laminated to cross laminated, high-density polyethylene film. Self sealing. Specifically designed to be self-adhered to a prepared substrate, providing an air / vapour / water barrier. Provide in maximum practical widths to suit location on wall or roof deck. Provide in regular or high temperature ort low temperature versions to suit application conditions.
  - .1 Nominal total thickness: 1.0 mm. (40 mils)
  - .2 Elongation: to ASTM D412 (modified). 200 % minimum.
  - .3 Tensile strength membrane: to ASTM D412 (modified). 3.4 MPa.
  - .4 Tensile strength film: to ASTM D882: 40 Mpa.
  - .5 Minimum puncture resistance: to ASTM E154/E154M: 178 N.
  - .6 Water vapour transmission: to ASTM E96/E96M (desiccant method). 2.0 ng / Pa/second/square meter. (0.03 perms).
  - .7 Air Leakage @75 Pa: to ASTM E283: 0.003 L/second/square meter.
  - .8 Roll length: 23 m.
- .2 Transition membranes: by same manufacturer as SBS A/V barrier membrane. Self adhering SBS membrane and flashings. Purpose designed for use in creating continuous seal to elements penetrating exterior air / vapour barrier membrane.

- .3 Adhesive: by same manufacturer as SBS A/V barrier membrane. Trowel consistency, synthetic rubber-based insulation adhesive. Solvent-type, smooth-spreading adhesive that can be applied at temperatures down to minus 12°C. High initial strength, early set to create a strong, resilient bond. For bonding rigid board insulations to air / vapour barrier membrane.
- .4 Air Barrier Accessories: by same manufacturer as Air Barrier. Specifically designed for use with SBS membrane.
  - .1 Flashing membranes: Flexible membrane flashing materials for window openings and penetrations. Straight and curved flashing membranes for flashing windows and doors and sealing penetrations.

## **2.02 SEALANTS**

- .1 Sealants and primer: as recommended by barrier manufacturer. Appropriate to application.
- .2 Thinner and cleaner: Non-corrosive type as recommended by manufacturer. Compatible with adjacent materials.

## **Part 3 Execution**

### **3.01 EXAMINATION**

- .1 Verify that surfaces and conditions are ready to accept the Work of this section.
- .2 Ensure all surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.
- .3 Report any unsatisfactory conditions to Consultant in writing.
- .4 Do not start work until deficiencies have been corrected. Commencement of Work implies acceptance of conditions.
- .5 Sequence work to permit installation of materials in conjunction with related materials and seals.

### **3.02 PREPARATION**

- .1 Remove loose or foreign matter which might impair adhesion of materials.
- .2 Ensure all substrates are clean of oil or excess dust; all joints are flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.
- .3 Ensure all substrates are free of surface moisture prior to application of primer and self-adhesive membrane.
- .4 Ensure metal closures are free of sharp edges and burrs.
- .5 Prime substrate surfaces to receive membrane in accordance with manufacturer's instructions.

### **3.03 INSTALLATION**

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program requirements for installation.
- .3 Apply primer and install self adhesive membrane to concrete and gypsum board materials. Caulk openings, penetrations and joints with transition membranes with sealant to ensure complete seal. Position lap seal over firm bearing.

- .4 Lap sheet onto roof vapour barrier and seal with sealant. Caulk to ensure complete air seal. Position lap seal over firm bearing.
- .5 Install SBS transition membrane between wall Air/Vapour Barrier membrane and window and door frames. Caulk to ensure complete seal. Position lap seal over firm bearing.
- .6 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

**3.04 PROTECTION OF WORK**

- .1 Protect finished Work in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure finished Work is protected from climatic conditions.

**3.05 SCHEDULES**

- .1 Wall air / vapour barrier over gypsum board sheathing: self adhesive, SBS membrane.
- .2 Window and door frame. Lap transition membrane at perimeter of frame 75 mm onto surface of wall membrane. Install over firm bearing and seal edges with sealant.
- .3 Wall and roof junction: Lap wall membrane 150 mm onto roof membrane with full contact. Seal with sealant.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.
- .2 Section 08 44 13 - Glazed Aluminum Curtain Walls.

**1.02 REFERENCES**

- .1 American Architectural Manufacturer's Association. (AAMA).
  - .1 AAMA 508-14. Voluntary Test Method and Specification for Pressure-Equalized Rain-Screen Wall Cladding Systems.
  - .2 AAMA 2605-13. Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels. (With Coil Coating Appendix).
- .2 American Society for Testing and Materials (ASTM International).
  - .1 ASTM A653/A653M-15e1. Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM A792/A792M-10(2015). Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .3 ASTM B209-14. Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - .4 ASTM D3363-05(2011)e2. Standard Test Method for Film Hardness by Pencil Test.
  - .5 ASTM E283-04(2012). Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - .6 ASTM E330/E330M-14. Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .7 ASTM E331-00(2016). Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

**1.03 DESIGN REQUIREMENTS**

- .1 Design the wall panel system as a dry joint type of system that does not rely on caulking to prevent the penetration of water to the interior. Face sealed joint systems are not acceptable. Design the system to allow for the removal and replacement of individual panels within the completed assembly. Design the system with an overall depth of as indicated in the drawings with a minimal panel joint width as indicated.
- .2 Design the exterior panels formed from solid sheet aluminum for insertion into the curtain wall framing system or direct installation to attachment system.
- .3 Design panel system as a pressure equalized rainscreen system. Prevent the penetration of rain to the face of the interior back up wall. Provide an open type system with out the use of caulking or gaskets to maintain weather tightness. Incorporate means of draining moisture to the exterior face of the wall system. Design Pressure Equalized Rain Screen System to comply with AAMA 508 Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems.



- .4 Design the attachment system as a manufacturer engineered component. Provide a 2 component, thermally broken, horizontal and vertical Z-bar system. Minimum 1.25 mm thickness. Overall depth to match insulation layer and as detailed. Aluminum-zinc alloy coated sheet steel to ASTM A792, commercial quality with AZ 180 coating minimum. Thickness as per manufacturer's engineered design as required to accommodate thermal movements, design loading and wind loading.
- .5 Wind loading: Design the system to resist wind loads, both positive and negative without causing rattling, vibration, or excessive deflection of panels or overstressing of fasteners or clips.
- .6 Design the wall system to resist local Design Wind Loads in accordance with the NBC. Design to a minimum pressure of 3.12 kPa. Conduct Wind load testing in accordance with ASTM E 330 to obtain the following results:
  - .1 Normal to the plane of the wall between supports, deflection of the secured perimeter framing members shall not exceed  $L/175$  or 19mm, whichever is less.
  - .2 Normal to the plane of the wall, the maximum panel deflection shall not exceed  $L/60$  of the full span.
  - .3 Maximum anchor deflection shall not exceed 1.6mm.
  - .4 At the design pressure, permanent deflections of framing members shall not exceed  $L/100$  of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1.6mm.
- .7 Structural and Thermal Movement: accommodate movement of supporting structural framing and movement caused by thermal expansion and contraction of the system component parts across an ambient temperature range of 80°C without causing bowing, buckling, delamination, oil canning, failure of joint seals, excessive stress on fasteners or other detrimental effects.
- .8 Air Leakage: design system to obtain a maximum value of 0.003 L/second/square meter of wall area at a pressure difference of 300 Pa when tested to ASTM E283.
- .9 Water penetration: design system to obtain no water infiltration under static pressure when tested to ASTM E331 at a pressure level of minimum 700 Pa for 15 minutes. Water penetration is defined as the appearance of uncontrolled water in the wall.

#### 1.04 SUBMITTALS

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, specifications and data sheets. Submit product data sheets for system materials. Include product characteristics, performance criteria, limitations and colours.
- .3 Submit shop drawings. Indicate dimensions and thickness of panels, fastening and anchoring methods, detail and location of joints and gaskets, thermal movement provision. Provide elevations of each wall including wall openings. Provide head, jamb and sill details. Indicate materials and finish, compliance with design criteria and requirements of related work.
- .4 Submit Engineered, stamped shop drawings. Indicate location, quantity, dimensions and thickness of Z-bars, girts and sub-girt system assemblies. Provide drawings indicating all design data. Submit drawings sealed and signed by a Professional Engineer licensed to practice in the Province of Ontario.
- .5 Submit duplicate 100 x 100 mm samples of wall system components, representative of materials, finishes and colours. Submit 300 mm long samples of sub-girts, extrusions and brackets. Submit samples of anchors, fasteners, joint filler strips and accessories.

- .6 Submit duplicate 100 x 100 mm samples of finished sheet aluminum panels. Submit sample fabricated from specified material in specified finish and colour.
- .7 Submit Manufacturer's installation instructions.

**1.05 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.06 QUALITY ASSURANCE**

- .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.
- .4 Manufacturer: Company specializing in performing work of this section with a minimum of 15 years documented experience in design and installation of Composite Panel Wall system.
- .5 Installer: company who is certified and licensed by system manufacturer.

**1.07 MOCK-UP**

- .1 Construct Mock-Up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct typical exterior wall panel, minimum 1500 mm wide by full height, incorporating typical window and door frame. Include sill, support system, insulation and air barrier interface. Include building corner condition, junction with roof system. Illustrate material interface and seals.
- .3 Mock-Up to include standard panel, sloped panel, wrap around panel and soffit including joints and junctions with adjacent materials.
- .4 Locate Mock-Up where directed by Consultant. Allow 24 hours for inspection of Mock-Up by Consultant before proceeding with air barrier Work.
- .5 Approved Mock-Up may remain as part of the Work.

**1.08 DELIVERY, STORAGE AND HANDLING**

- .1 Store and protect material in accordance with panel manufacturer's recommendations.
- .2 Protect panel face with a strippable plastic film adhered to panel in accordance with Manufacturer's directions. Do not expose panels with strippable film to direct sunlight or extreme heat.

**1.09 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management.
- .2 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.
- .3 Dispose of unused sealant material at official hazardous material collections site approved by Consultant.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Panels: sheet aluminum to ASTM B209. 1/8 inch, 0.125 (3.1750 mm) thick sheets. Alloy and temper as recommended by Manufacturer. Brake form to sizes and shapes for panels as indicated.
- .1 Panel sizes: custom sizes as indicated in the drawings.

**2.02 ALUMINUM FINISHES**

- .1 Painted finish meeting AAMA 2605. Finish Panels with same finish, colour and gloss as specified for Aluminum Curtain Wall components as specified in Section 08 44 13 - Glazed Aluminum Curtain Walls. Properties as follows:
  - .1 Dry film thickness: to ASTM D7091. Coating thickness 1.2 mil.
    - .1 Primer: 0.2 - 0.3 mils.
    - .2 Colour coat: 0.70 - 0.80 mil.
    - .3 Clear coat: 0.60 - 0.70 mil.
  - .2 Pretreatment: multi stage cleaning with chrome phosphate conversion coating at 40 mg per square foot minimum. Thoroughly clean using a multi stage cleaning process to remove organic and organic surface soils and residual oxides. Apply a chemical conversion coating to which organic coatings will firmly adhere.
  - .3 Dry film hardness: to ASTM D3363. F minimum.
  - .4 Impact resistance: 1/10 inch deformation. No loss of adhesion.
  - .5 Abrasion resistance: to ASTM D968. Coefficient of 40 minimum.
  - .6 Color retention: 10 years south Florida. Maximum 5 delta E.
  - .7 Gloss retention: minimum 50 % after 5 years south Florida.
  - .8 Corrosion resistance: 4000 hours. Humidity / salt spray.
  - .9 Salt spray: to ASTM G85. 2000 hours. Annex A5: Scribe or cut edges: Rating 7. Field rating 8.
  - .10 Humidity resistance: to ASTM D2247 or ASTM D4585. 4000 Hours. Few number 8 Blisters Maximum.
  - .11 10 % muriatic acid spot rest. 15 minutes. No blistering or visual change.
  - .12 Mortar (alkali) resistance: 24 hour spot test. No visual change.
  - .13 72 hour detergent immersion at 100 degrees F: No loss of adhesion.
  - .14 Boiling water adhesion: no removal of film after 20 min. exposure.
  - .15 Chalking resistance: no more than number 8. Number 6 for whites.
  - .16 Erosion resistance: less than 10 % after 10 years south Florida.
  - .17 PVDF content: minimum 70 % by volume weight into the paint system. Kynar 500 or Hylar 5000 resins plus durable ceramic pigments.
  - .18 Colour: White. Selected by Consultant from full and extended range of available colours. To match Curtain wall components as specified in Section 08 44 13 - Glazed Aluminum Curtain Walls.
  - .19 Gloss: to ASTM D523. Low and Medium. Gloss level will be selected by Consultant.

**2.03 SYSTEM COMPONENTS**

- .1 Sub-girts: 2 component, thermally broken. Fabricate from aluminum-zinc alloy coated steel sheet to ASTM A653/A653M, commercial quality, with Z275 zinc coating, regular spangle

surface. Thickness as per manufacturer's design as required to accommodate thermal movements and design loading.

- .2 Support structure: manufacturer's proprietary multi component aluminum extrusions. Manufacturer's standard profiles as indicated in the drawings.
- .3 Fasteners: 300 series stainless steel or 400 series stainless steel cadmium plated and finished to match adjacent material. Of sufficient size and quantity to perform their intended function.
- .4 Panel clips: manufacturer's standard extruded aluminum clips for fastening the panels to the sub structure. Provide continuous extrusions at the perimeter of each panel for reinforcement and alignment. Intermittent clips are not acceptable.
- .5 Shims: as provided by manufacturer to provide thermal separator between extrusions and sub girts.
- .6 Joint filler strip: same material and colour as panel.
- .7 Parapet coping, column covers, soffits, flashing adapters sills and border: manufacturer's standard components: as indicated and as required for the completion of the panel system.
- .8 Sealants: TYPE A: one component, medium modulus, neutral cure silicone as specified in Section 07 92 10 - Joint Sealing.

## **2.04 FABRICATION**

- .1 Shop fabricate aluminum panels from break formed sheet aluminum. Fabricate panel to sizes shapes and profiles as indicated.
- .2 Fabricate panel lines, breaks and angles with sharp, true edges and surfaces free from warp or buckle.
- .3 Fabricate panels with 4.0 mm radius outside corners or as determined by alloy and temper of sheet aluminum.
- .4 Tolerances: fabricate panels not to exceed the following:
  - .1 Panel bow: maximum 0.8% of panel dimension in width and length.
  - .2 Rises and falls across panel (local bumps and depressions): zero.
  - .3 2.0 mm in a concave / convex direction, measured perpendicular to normal plane.
  - .4 Panel dimensions: where final dimensions cannot be established by field measurement before completion of panel manufacturing, make allowance for field adjustments as recommended by manufacturer.
- .5 Joints: typical panel joint width: 13 mm dry joint system.

## **Part 3 Execution**

### **3.01 EXAMINATION**

- .1 Before installation, examine alignment of substrate and notify Consultant in writing if substrate does not comply with requirements of panel installer.

### **3.02 INSTALLATION**

- .1 Install composite panels in accordance with manufacturer's written instructions and shop drawings. Allow for thermal movement.

- .2 Install sub girts, support structure, joint filler strip and panels to meet specified design criteria and performance.
- .3 Install complete system securely anchored, free of distortion and surface imperfections. Install panels plumb, true and level with all joints in alignment and flush with adjacent panels.
- .4 Use concealed fastening only.
- .5 Maintain following installation tolerances:
  - .1 Maximum variation from plane or location shown on shop drawings: 10 mm/10 m of length and up to 20 mm/100 m.
  - .2 Maximum deviation for vertical alignment of members: 3 mm in an 8.5 m run.
  - .3 Maximum deviation for a horizontal alignment of member: 3 mm in an 8.5 m run.
  - .4 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.
- .6 Remove protective coating from panels as they are erected.
- .7 Repair and touch up minor surface damage with colour matched enamel.
- .8 Replace damaged panels which cannot be repaired to approval of Consultant.

**3.03 CLEAN-UP**

- .1 Leave work areas clean, free from grease, finger marks and stains.

**END OF SECTION**

**PART 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.

**1.02 REFERENCES**

- .1 DIN. Deutsches Institut Fur Normung E.V. (German National Standard),
  - .1 DIN EN 12467:2012. Fibre-cement flat sheets. Product specification and test methods.
  - .2 DIN 4102-9: 1990. Fire behaviour of building materials and elements; seals for cable penetrations; concepts, requirements and testing.
- .2 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN/ULC-S114-05. Standard Method of Test for Determination of Non-Combustibility in Building Materials.

**1.03 DESCRIPTION**

- .1 Composite fiberglass reinforced concrete panels. Installation to exterior wall assemblies and soffits with supplementary framing using concealed fastener systems. Anchors, supports and accessories as shown in drawings for a complete installation. Installation with open, ventilated joints.

**1.04 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of current technical data sheets for each component. Include materials' physical properties, performance criteria, physical size, finish and limitations.
- .3 Submit data sheets describing materials and fabrication for aluminum attachment system and components.
- .4 Submit test data verifying panel performance characteristics.
- .5 Submit Material Safety Data Sheets. Indicate VOC content for primers, adhesives or sealants.
- .6 Submit shop drawings. Include pertinent details for installation of suspension system and panels. Submit elevations showing panel layout and joint locations. Indicate panel profiles and dimensions, product components, edge conditions, special shapes, and trim pieces. Indicate alignment details and panel sizes. Provide details for hidden attachment, supports, accessories and corner details. Indicate control joint locations and details. Provide details for mechanical fasteners for each component.
- .7 Submit engineering calculations. Submit drawings signed and sealed by a Professional Engineer registered in Ontario attesting adequacy of system to meet required loads. Include structural calculations for support systems.
- .8 Submit manufacturer's installation instructions. Provide attachment methods, details, fasteners, joints, corners, openings, intersections with adjacent materials, flashings, closures, trim, and other critical conditions.
- .9 Sustainable Design Submittals LEED. Submit documentation in accordance with Section 01 35 21 - LEED Requirements.

- .10 Submit duplicate 300 x 300 mm sample pieces of panels. Submit samples of complete colour range in specified finish. Submit 200 mm lengths of all suspension and support components, typical attachment brackets and anchors. Submit samples of exposed fasteners.
- .11 Closeout Submittals: Provide maintenance data for panels for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### **1.05 QUALITY ASSURANCE**

- .1 Manufacturer: minimum 3 years demonstrated capability to produce panels of the quality and scope required.
- .2 Installer Qualifications. Approved by panel manufacturer with 3 years of experience installing similar panel systems.

#### **1.06 MOCK-UP**

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock-up a minimum of 4 panels wide x 2 panels high. Include one inside corner and one outside corner detail. Include a door or window opening. When approved, Mock-up may be part of finished work.
- .3 Allow 24 hours for inspection of mock-up by Consultant before proceeding.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and Manufacturers written instructions.
- .2 Transport, lift, and handle panels using appropriate equipment. Handle with care, avoiding excessive stress and preventing damage.
- .3 Store products in manufacturer's unopened packaging until ready for installation, in a clean dry area protected from weather, moisture and damage. Store units upright and not stacked unless permitted by manufacturer.
- .4 Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **PART 2 Products**

#### **2.01 MATERIALS**

- .1 Concrete panels: extruded, glass fibre reinforced concrete panel. Fabricated from pure mineral raw materials. Properties as follows:
  - .1 Reinforced with alkali resistant glass fibres as continuous linear glass fibre strands and short fibres in matrix.
  - .2 Panel size: maximum 1200 x 3600 mm.
  - .3 Thickness: 13 mm.
  - .4 Tolerances:
    - .1 Thickness: max plus/minus 1.3 mm.
    - .2 Edge straightness: plus / minus 0.1 % to EN 12467. (Level 1).
    - .3 Perpendicularity: plus / minus 2 mm per meter to EN 12467. (Level 1).
  - .5 Mass: 26 - 31.5 kg per square meter at 13 mm panel thickness.

- .6 Binding tensile strength: to EN 12467. Minimum 18 MPa.
- .7 Elasticity Module: 20000 N per square mm.
- .8 Building material: class A1 to DIN 41029.
- .9 Waterproofness: to EN 12467. Passed.
- .10 Thermal and rain testing: to EN 12467. Passed
- .11 Frost resistance: to EN 12467. Passed
- .12 Flammability: to CAN/ULC S114. Classified as non-combustible.
- .13 Colour: colour to extend completely though panel. Colours will be selected from manufacturers full range of 10 standard colours.
- .14 Surface texture: selected from manufacturers standard range: Sandblasted: Ferro.
- .15 Acceptable Material: FibreC by Rieder.

## **2.02 ATTACHMENT SYSTEM**

- .1 Exterior: manufacturer's fully concealed system using undercut anchors.
  - .1 Substructure: concealed assembly of extruded aluminum brackets. Adjustable.
  - .2 Fasteners.
    - .1 Substructure to structural framing: manufacturer's standard components to suit conditions and loading.
    - .2 Panel to substructure: panel mounting details as approved by panel manufacturer.
  - .3 Joint width: approximately 5.0 mm.

## **2.03 ACCESSORIES**

- .1 Adhesive: as recommended by panel manufacturers.
- .2 Joint sealants: as specified in Section 07 92 10. Select products that are approved by panel manufacturer.

## **2.04 FABRICATION**

- .1 Factory fabricate panels. Fabricate to finished sizes as per approved Shop Drawings. Site cutting will be restricted to trim and cutting openings for electrical and mechanical items.
- .2 Prepare panels for attachment brackets in accordance with Manufacturers instructions.

# **PART 3 Execution**

## **3.01 WORKMANSHIP**

- .1 Install system in accordance with manufacturer's written data, including product technical bulletins, installation instructions, carton installation instructions, and datasheet. Manufacturer's recommendations will be considered as minimal instructions.
- .2 Install all supports, panels, closures and trim in accordance with manufacturers written installation instructions and approved shop drawings.

## **3.02 PREPARATION**

- .1 Verify existing conditions before starting work. Examine surfaces scheduled to receive panels for unevenness, irregularities and dampness that would affect quality and execution of work. Do not proceed with installation until unacceptable conditions are corrected. Verify that



adjacent materials and surfaces are dry, free of obstructions, and ready to receive system installation.

- .2 Ensure that concrete or stud wall assembly is plumb and dimensions are per the Shop Drawings and Layout Drawings.
- .3 Examine walls to receive cladding system. Ensure substrate is structurally sound, clean, and free of contaminants which inhibit installation.
- .4 Verify stud framing is adequately braced without deflection and sheathing is properly secured with edges over firm bearing. Ensure proper framing and supports are provided and located for secure attachment of support components.
- .5 Maximum substrate deflection:  $L/360$  or as recommended by Panel Manufacturer.
- .6 Maximum substrate surface variation: 3 mm in 3000 mm.
- .7 Do not proceed with installation until deficiencies have been addressed.

### 3.03 INSTALLATION

- .1 Establish level lines for panel coursing and positioning of supports.
- .2 Supports. Attach horizontal and vertical supports with engineered fasteners and anchors to accomplish performance requirements. Attach supports to substrate at spacing as recommended by system manufacturer in accordance with lateral loads and system dead load requirements.
- .3 Provide expansions space between ends of adjacent rails for expansion and contraction of aluminum components
- .4 Install support framing plumb and true to line. Shim where necessary.
- .5 Panels. Starting at bottom of wall, install panels by fastening into aluminum support profiles at location of predrilled holes. Install using fastener system that is completely invisible in final assembly.
- .6 Layout work so as to avoid or minimize cuts. Site cut panels to prevent broken corners, edges, and chips.
- .7 Install panels with vertical and horizontal joints as indicated in the drawings. Install with vertical and horizontal joints approximately 5 mm wide.
- .8 Install panels in proper alignment with straight tight joints and flush intersections.
- .9 Tolerances: shim and align panels to provide a deviations from level or plumb alignment: 6 mm in 6.0 m maximum. Non accumulative.
- .10 Adjust panels for flush intersections with adjacent panels in any direction. Maximum lippage 1.0 mm.

### 3.04 CLEANING

- .1 Clean all dirt, marks and sealant from panels using methods appropriate for the type of finish and per manufacturer's recommendations.
- .2 Remove and replace broken, chipped, stained, or otherwise damaged panels.
- .3 Immediately after installing, wipe down work. Do not use wire brushes, metallic tools, or abrasives for cleaning.

**3.05 PROTECTION**

- .1 Protect cladding from roof run-off, splashed water, mud, sealants, bitumen, and other contaminants from remaining construction activities.
- .2 Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 05 31 00 - Steel Decking.
- .2 Section 06 10 00 - Rough Carpentry.
- .3 Section 07 21 13 - Board Insulation.
- .4 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .5 Section 07 92 10 - Joint Sealants.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C472-99(2014). Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete.
  - .2 ASTM C1371-15. Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
  - .3 ASTM C1549-09(2014). Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
  - .4 ASTM D994/D994M-11. Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
  - .5 ASTM D1970/D1970M-15a. Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
  - .6 ASTM D5602/D5602M-11. Standard Test Method for Static Puncture Resistance of Roofing Membrane Specimens.
  - .7 ASTM D6162/D6162M-00A(2015)e1. Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
  - .8 ASTM D6164/D6164M-11. Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
  - .9 ASTM E96/E96M-16. Standard Test Methods for Water Vapor Transmission of Materials.
  - .10 ASTM E154/E154M-08a(2013)e1. Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
  - .11 ASTM E1980-11. Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
  - .12 ASTM E2178-13. Standard Test Method for Air Permeance of Building Materials.
- .2 Canadian General Standards Board (CGSB).
  - .1 CGSB 37-GP-56M-80b(A1985). Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
- .3 Canadian Roofing Contractors Association (CRCA).
  - .1 Roofing Specifications Manual - 2012.
- .4 CSA Group.

- .1 CAN/CSA-A123.21-14. Standard test method for the dynamic wind uplift resistance of membrane-roofing systems.

### 1.03 PERFORMANCE REQUIREMENTS

- .1 Compatibility between components of roofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in this system, meet this requirement.
- .2 Roofing systems to be tested and certified to meet a Dynamic Uplift Resistance in accordance with CAN/CSA-A123.21. Design systems as exposed or ballasted roof systems as indicated below using the available wind data from SIGDERS for the site location. Safety factor: 1.5.
  - .1 System R1: exposed membrane, insulated over a concrete deck.
    - .1 Concrete deck.
    - .2 Primer.
    - .3 Vapour Barrier. Self adhesive.
    - .4 Adhesive.
    - .5 Insulation. 2 layers. Installed in coating of adhesive.
    - .6 Overlay protection board. Installed in coating of adhesive.
    - .7 Base sheet and cap sheet membrane. Torch applied
    - .8 Membrane flashings. Torch applied.
  - .2 System R2: exposed membrane, insulated over metal deck.
    - .1 Metal deck.
    - .2 Deck covering. Installed with screws.
    - .3 Primer.
    - .4 Vapour Barrier. Self adhesive.
    - .5 Adhesive.
    - .6 Insulation. 2 layers. Installed in coating of adhesive.
    - .7 Overlay protection board. Installed in coating of adhesive.
    - .8 Base sheet and cap sheet membrane. Torch applied
    - .9 Membrane flashings. Torch applied.
  - .3 System R3: exposed membrane, non-insulated over a metal deck.
    - .1 Metal deck.
    - .2 Deck covering. Installed with screws.
    - .3 Base sheet and cap sheet membrane. Torch applied
    - .4 Membrane flashings. Torch applied.
  - .4 System R6: ballasted membrane, insulated over metal deck.
    - .1 Metal deck.
    - .2 Deck covering. Installed with screws.
    - .3 Primer.
    - .4 Vapour Barrier. Self adhesive.
    - .5 Adhesive.
    - .6 Insulation. 2 layers. Installed in coating of adhesive.
    - .7 Overlay protection board. Installed in coating of adhesive.
    - .8 Base sheet and cap sheet membrane. Torch applied
    - .9 Membrane flashings. Torch applied.

- .10 Stone ballast.

#### **1.04 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of current technical data sheets for each roofing component. Include materials' physical properties, performance criteria, physical size, finish and limitations.
- .3 Submit Material Safety Data Sheets. Indicate VOC content for: primers, adhesives, asphalt or sealers and membranes.
- .4 Submit shop drawings indicating details and layouts for control joints and insulation. Indicate layout for mechanical fasteners for each roof area.
- .5 Submit 2, one litre sized cans of stone ballast.
- .6 Submit manufacturer's installation instructions. Indicate special precautions required for sealing the membrane joints. Indicate acceptable installation temperatures and wind conditions for each product.
- .7 Sustainable Design Submittals LEED. Submit documentation in accordance with Section 01 35 21 - LEED Requirements.
- .8 Provide maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

#### **1.05 QUALITY ASSURANCE**

- .1 Submit laboratory test reports in accordance with Section 01 45 00 - Quality Control.
- .2 Submit Manufacturer's Certificate, certifying that products meet or exceed specified requirements.
- .3 Submit laboratory test reports certifying compliance of membranes with specification requirements.
- .4 Submit Roof System Assessment Report of Wind Uplift Resistance confirming that system meets specified requirements. Provide report from independent testing firm qualified to carry out testing in accordance with CSA A23.21.
- .5 Convene pre-installation meeting one week prior to beginning Work, with roofing contractor, Contractor and Consultant. Meeting to verify the following requirements:
  - .1 Review installation and substrate conditions.
  - .2 Determine co-ordination with other building subtrades.
  - .3 Review manufacturer's installation instructions and warranty requirements.
- .6 Installer qualifications: company or person specializing in application of modified bituminous roofing systems. Roofing contractors and sub contractors must be registered with membrane manufacturer's Quality Assurance program. Submit a written certificate issued by membrane manufacturer before beginning any roofing work.

#### **1.06 DELIVERY STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements
- .2 Handle roofing materials in accordance with manufacturer's written directives to prevent damage or loss of performance.
- .3 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

- .4 Provide and maintain dry, off-ground weatherproof storage. Store insulation protected from daylight, weather, and deleterious materials. Store rolls of membrane in upright position. Store membrane rolls with selvage edge up.
- .5 Store sealants at plus 5 degrees C minimum.
- .6 Remove only in quantities required for same day use.
- .7 Place plywood runways over completed Work to enable movement of material and other traffic.

#### **1.07 PROTECTION**

- .1 Fire extinguishers: maintain one cartridge operated type or stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection. Minimum size: 14 kg or as permitted by Consultant. Maintain one extinguisher per torch applicator, within 6 m of torch applicator at all times.
- .2 Maintain fire watch for 2 hours after each day's roofing operations cease.
- .3 At the end of each workday, use a heat detector gun to spot any smoldering or concealed fire.

#### **1.08 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove for reuse and return to by manufacturer, all pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .2 Collect and separate for disposal steel, paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal materials from landfill to recycling facility as approved by Consultant. Fold up metal banding, flatten and place in designated area for recycling.
- .4 Hazardous Materials: All hazardous materials which cannot be reused are regarded as hazardous products and are subject to regulations for disposal. Safely store materials defined as hazardous or toxic waste, including emptied containers and application apparatus in containers or areas designated for hazardous waste and dispose of contaminants in an approved legal manner. Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

#### **1.09 ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install roofing when temperature remains below minus 10 degrees C for torch application and to manufacturers' recommendations. Minimum temperature for solvent based adhesive systems: plus 5 degrees C.
- .2 Install roofing on dry deck, free of snow and ice. Use only dry materials and apply only during weather that will not introduce moisture into roofing system.

#### **1.010 WARRANTY**

- .1 Membrane: Provide a written and signed document from the membrane manufacturer. Provide Warranty in the owner's name, certifying that the roofing membranes are free of manufacturing defects for a period of ten years, starting from the date of completion of membrane installation. Warranty will cover the removal and replacement of defective roof membrane products, including workmanship. Warranty to remain full and complete for the duration of the period specified. The warranty certificate must reflect these requirements.

- .2 Workmanship. Provide a warranty certificate from the contractor. Provide a written and signed document in the owner's name certifying that the work executed will remain in place and free of waterproofing defect for a 2 year period starting from the date of acceptance.

## **Part 2 Products**

### **2.01 PRIMER**

- .1 Primer: by membrane manufacturer. Primer designed to enhance the adhesion of self adhesive vapour barrier membranes to concrete or gypsum board substrates. Rated for application at minimum temperature of minus 10 degrees C. Formulated of SBS synthetic rubbers, adhesive enhancing resins and volatile solvents.

### **2.02 DECK COVERING**

- .1 Glass mat roof board: high performance, water resistant treated gypsum core roofing board. 12.7 mm thick, 1220 mm wide x maximum practical length. Fiberglass matt facers provide mould and moisture resistance. Fire performance: Class A rating to ULC. Nominal weight: 2.0 pounds per square foot. Nominal compressive strength: 700 - 1000 psi.
- .2 Fasteners: roof board to steel deck: No. 10 flat head, self tapping, Type A or AB, cadmium plated screws, and plates minimum 12 per board.

### **2.03 VAPOUR BARRIER**

- .1 Vapour Barrier: Styrene - Butadiene - Styrene (SBS) membrane to ASTM D6164/D6164M. Elastomeric polymer prefabricated sheet, glass or polyester reinforcement, weighing minimum 180 g/m<sup>2</sup>. Self adhesive membrane for warm weather application. ULC certification: Class A. Nominal thickness: 0.8 mm. Nominal weight: 0.77 kg per square metre. (0.16 pounds per square foot.). Properties as follows:
  - .1 Composition: SBS modified bitumen and a tri laminated woven polyethylene facer. Bottom surface covered with a silicone release film.
  - .2 Static puncture: to ASTM D5602/D5602M. 400 N (90 pound feet).
  - .3 Tear resistance, MD/XD: to ASTM D1970/D1970M. 423 / 458 N. (95 / 103 pound feet).
  - .4 Water vapour permeance: to ASTM E96/E96M (Procedure B). 1.7 ng/Pa per second per square meter. (0.03 perm).
  - .5 Air permeability: to ASTM E2178. less than 0.001 litres per second per square meter.

### **2.04 MEMBRANES**

- .1 Base sheet: to ASTM D6162/D6162M, Type 1 (fully adhered) and CGSB 37-GP-56M. High performance Styrene - Butadiene - Styrene (SBS) elastomeric polymer prefabricated sheet with composite reinforcement. ULC certification: Class A. Properties to CGSB 37-GP-56M as follows:
  - .1 Top and bottom surfaces: covered with a thermofusible plastic film for heat welded installation.
  - .2 Thickness: 2.5 mm (98 mils).
  - .3 Reinforcement: composite.
  - .4 Dimensions: 1000 mm x 10 m roll length.
  - .5 Weight: 3.3 kg per square metre (0.7 pounds per square foot.).
  - .6 Breaking strength: MD: 15 kN / metre. XD: 13.5 kN / metre.

- .7 Ultimate elongation: MD: 60 %. XD: 65 %.
- .8 Tear resistance: 125 N.
- .9 Static puncture resistance: 560 N.
- .10 Dimensional stability: MD: 0.2 %. XD: 0 %.
- .11 Plastic flow: greater than 110 degrees C. (230 degrees F).
- .12 Cold bending at minus 30 degrees C. (minus 22 degrees F). No cracking.
- .2 Cap sheet membrane: high performance membrane to ASTM D6162/D6162M (Type 1 - Fully adhered) and CGSB 37-GP-56M. Styrene - Butadiene - Styrene (SBS) modified Bitumen elastomeric polymer with a composite reinforcement and a surface covered with highly reflective white granules. Properties: to CGSB 37-GP-56M as follows:
  - .1 Thickness: 3.7 mm (146 mil).
  - .2 Reinforcement: composite.
  - .3 Dimensions: 1000 x 10 meter roll length.
  - .4 Weight: 4.2 kg per square metre (0.86 pounds per square foot).
  - .5 Surfaces: top face: highly reflective white granules. Bottom face: thermofusible plastic film for heat welding application.
  - .6 SRI when tested to ASTM E1980. Minimum 84. Reflectivity measured to ASTM C1549. Emissivity measured to ASTM C1371.
  - .7 Strain energy: MD: 11.9 kN/metre. XMD: 9.5 kN/metre.
  - .8 Breaking strength: MD: 19.5 kN/metre. XMD: 15.1 kN/metre.
  - .9 Ultimate elongation: MD: 61 %. XMD: 75 %.
  - .10 Tear resistance: 70 N.
  - .11 Static puncture resistance: 470 N.
  - .12 Dimensional stability: MD: -0.2 %. XMD: 0.1 %.
  - .13 Plastic flow: greater than 110 degrees C (230 degrees F).
  - .14 Cold bending, at minus 30 degrees C (minus 22 degrees F). No cracking.
- .3 Membrane Flashings: base sheet membrane flashing and cap sheet membrane flashings: cut from same SBS membrane base sheet and cap sheet as specified above.

## 2.05 OVERLAY PROTECTION BOARD

- .1 By membrane manufacturer. Semi-rigid board composed of mineral fortified asphaltic core, between two layers of asphalt saturated fiberglass. Designed as a substrate material for membranes intended to be installed over insulation. Compatible with modified bitumen membranes. Properties as follows:
  - .1 Thickness: 6.4 mm (1/4 in).
  - .2 Board size: 1220 x 1520 mm.
  - .3 Nominal weight: 9.3 kg per square metre. (1.90 pounds per square foot).
  - .4 Puncture resistance: to ASTM E154/E154M. 500 N.
  - .5 Water absorption: to ASTM D994/D994M. 0.25 %.
  - .6 Compressive strength: to ASTM C472. Greater than 3565 kPa (517 psi).

## 2.06 ADHESIVES

- .1 Adhesive: cold applied adhesive by membrane manufacturer. Low rise, two component, polyurethane based adhesive. Specifically designed to adhere layers of insulation boards or gypsum based cover board to each other as well as to mod bit membranes.



**2.07 INSULATION**

- .1 Insulation: polyisocyanurate insulation as specified in Section 07 21 13 - Board Insulation. Provide in two separate layers.

**2.08 CARPENTRY**

- .1 Fascia, curbs and blocking: construct from pressure treated lumber and plywood materials as specified in Section 06 10 00 - Rough Carpentry. Construct to sizes and details as indicated and to match existing conditions as required.

**2.09 CANT STRIPS**

- .1 Prefabricated cant strips cut from 38 mm thick fibreboard material and laminated together to achieve a face width of 140 mm.

**2.010 ROOFING ACCESSORIES**

- .1 Expansion joint membrane: expansion joint designed to provide simultaneous 3 dimensional movements. By membrane manufacturer. Monolithic expansion joint comprised of two flanges coated on the surface and underface with a woven oxidized and stabilized polyacrylonitrile. Expandable core made of EPDM based synthetic rubber. Waterproofing membrane consisting of a polyester fabric with modified thermoplastic polymer bitumen. Bottom face covered with a thermofusible plastic film. Top surface has aluminum foil adhered to the centre of the membrane and covered by a release silicone film. Nominal thickness: 4.0 mm x 450 mm wide.
- .2 Roof Drain: fabricated with an integral flexible deck flange made from self adhesive SBS membrane with composite reinforcement crimped to an aluminum drain sleeve. Designed specifically for application to an SBS modified bitumen membrane roof assembly.
  - .1 Provide with an inversed basket shaped device fabricated from galvanized steel designed to retain and other detritus that could block the rainwater down pipe.
- .3 Wire and Cable flashing: prefabricated flashing assembly consisting of a flexible deck flange made from self adhesive SBS membrane with a composite reinforcement crimped to an aluminum sleeve designed to ensure watertightness around electrical wire and cable roof openings on roofs with an SBS modified bitumen membrane. Size to suit.
- .4 Vent flashing: prefabricated flashing assembly consisting of a flexible deck flange made from self adhesive SBS membrane with a composite reinforcement crimped to an aluminum sleeve designed to ensure watertightness around plumbing vents on roofs with an SBS modified bitumen membrane Sizes to suit.

**2.011 SEALANTS**

- .1 Sealants: as specified in Section 07 92 10 - Joint Sealants.
- .2 Waterproofing mastic: multi purpose mastic composed of SBS modified bitumen, fibres, mineral fillers and solvents. By membrane manufacturer for specific uses as designed.
- .3 Pitch pocket filler: polyester made precast blocks of various sizes. Filled with a single component, polyether based mastic and a single component, polyether based sealant and adhesive.
- .4 Sealing compounds: by membrane manufacturer for specific uses as designed. Bituminous / polyurethane waterproofing mono component resin and polyester reinforcement.

**2.012 STONE BALLAST**

- .1 Roofing stone: grey colour crushed limestone. Sized from 20- 40 mm size, well graded. Clear stone. Washed, free from fines, long splinters, moisture, ice and snow.

**Part 3 Execution**

**3.01 WORKMANSHIP**

- .1 Do examination, preparation and roofing Work in accordance with the membrane manufacturer's written instructions and CRCA Roofing Specification Manual.
- .2 Do priming in accordance with manufacturers written recommendations.

**3.02 PROTECTION**

- .1 Cover walls, walks, sloped roofs and adjacent work where materials hoisted or used.
- .2 Use warning signs and barriers. Maintain in good order until completion of Work.
- .3 Clean off drips and smears of bituminous material immediately.
- .4 Dispose of rain water off roof and away from face of building until roof drains or hoppers are installed and connected.
- .5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Consultant.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

**3.03 EXAMINATION OF ROOF DECKS**

- .1 Examine roof decking and immediately inform Consultant in writing of any defects. Inspect condition of existing decking with Consultant, including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed. Do not proceed with installation of new roofing until Consultant has approved condition of existing decking.
- .2 Prior to beginning of work ensure:
  - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
  - .2 Curbs have been built.
  - .3 Roof drains have been installed at proper elevations relative to finished roof surface.
  - .4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.
  - .5 Ensure that the intersection between the wall and roof assembly is prepared and sealed with a durable rigid material to create a connection point for the transition membrane connecting the wall and roof Vapour Barrier as well as the wall air barrier.
- .3 Do not install roofing materials during rain or snowfall.

**3.04 PREPARATION OF STEEL DECK**

- .1 Ensure welds and markings on steel decking are treated with galvanized touch up coating prior to application of deck covering.

**3.05 PREPARATION OF CONCRETE DECK**

- .1 Prepare surfaces of concrete deck according to membrane manufacturer's recommendations. Ensure that concrete deck surfaces have a surface profile acceptable to the membrane manufacturer.

**3.06 DECK COVERING**

- .1 Install deck covering boards continuously over roof deck. Mechanically fasten boards to steel deck with screws to upper rib deck surfaces. Place with long axis of each sheet transverse to steel deck ribs, with end joints staggered and fully supported on ribs.

**3.07 CURBS AND NAILERS**

- .1 Construct curbs and nailers as detailed. Provide continuous curbs at perimeter for fastening of membrane and flashings in accordance with applicable CRCA flashing details. Construct curbs full height of insulation.

**3.08 VAPOUR BARRIER MEMBRANE**

- .1 Apply primer by brush or roller to deck covering board or concrete structure in accordance with manufacturers instructions to achieve 100 % coverage.
- .2 Prime all horizontal and vertical surfaces scheduled to receive vapour barrier membrane and allow to thoroughly dry before applying membranes.
- .3 Ensure that primer is dry prior to the installation of the vapour barrier membrane. Remove one end of the release film and adhere the membrane to the substrate. Remove the remaining release film at a 45 degree angle to avoid wrinkles in the membrane.
- .4 Install vapour barrier membrane to concrete deck or deck covering board. Install membrane in accordance with manufacturer's written instructions to obtain a continuous, uninterrupted membrane. Extend membrane up vertical surfaces and over transition membranes to ensure positive and continuous contact with wall air and vapour barrier.
- .5 Side laps: 100 mm. End laps: 150 mm. Offset end laps a minimum of 300 mm.
- .6 After membrane has been installed, roll entire surface to ensure complete adhesion to substrate.

**3.09 EXPOSED MEMBRANE ROOFING APPLICATION**

- .1 Insulation: fully adhered, adhesive application:
  - .1 Adhere insulation to top surface of vapour barrier in full coating of adhesive. Apply adhesive at rate as specified by membrane manufacturer to accommodate polyisocyanurate insulation.
  - .2 Place insulation boards in 2 separate layers in full application of adhesive. Install with parallel rows with all edges and ends staggered and in firm contact with one another. Cut end pieces to suit.
- .2 Overlay Board: adhesive application. Adhere overlay board to top surface of insulation to provide torch safe surface.
  - .1 Place boards in parallel rows with end joints staggered. Offset joints in overlay board with joints in insulation. Apply overlay board in full application of adhesive at rate as recommended by membrane manufacturer.
- .3 Cant Strips. Install prefabricated cant strips over overlay board at junction with vertical surfaces. Adhere cant strip to receiving surface in full application of adhesive. Embed cant strip firmly by hand. Angle cut cants to fit tightly on back and bottom where vertical to horizontal angle varies from 90 degrees.
- .4 Base sheet application:
  - .1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and reroll from both ends.

- .2 Unroll and torch base sheet onto overlay board or gypsum deck covering board taking care not to burn membrane or its reinforcement or substrate.
- .3 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.
- .4 Application to be free of blisters, wrinkles and fishmouths.
- .5 Cap sheet application:
  - .1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.
  - .2 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.
  - .3 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet.
  - .4 Application to be free of blisters, fishmouths and wrinkles.
  - .5 Do membrane application in accordance with manufacturer's recommendations.
- .6 Flashings:
  - .1 Complete the installation of flashing base sheet stripping prior to installing membrane cap sheet.
  - .2 Torch base and cap sheet flashing membranes onto substrate in 1 metre wide strips.
  - .3 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal by torch welding.
  - .4 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.
  - .5 Provide 75 mm minimum side lap and seal.
  - .6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.
  - .7 Do work in accordance with manufacturer's recommendations.
  - .8 Prepare flashings for installation of pre-finished metal cap flashings as specified in Section 07 62 00 - Sheet Metal Flashing and Trim.

### 3.010 INSTALLATION OF ACCESSORIES

- .1 Roof penetrations:
  - .1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and detail.
- .2 Drains: install prefabricated drains in accordance with manufacturers instructions.
  - .1 Insert the drain sleeve into the rainwater drainage opening on the roof. Heat weld the cap sheet membrane on the roof drain flexible deck flange. Allow to cool and cut the roof drain hole. Position and centre the strainer at the upper rainwater drainage opening of the roof drain. Install the strainer.
- .3 Wire and cable flashing: install prefabricated flashing in accordance with manufacturers instructions
  - .1 Position and screw the steel flange over or under the structural support to stabilize the aluminum sleeve. Peel off the release protection film and adhere the flexible deck flange to the base sheet membrane. Seal the perimeter of the of the flexible deck flange. Heat weld the cap sheet membrane on the deck flange. Allow to cool and cut the opening.
- .4 Vent stack flashing: install flashing in accordance with manufacturers instructions.

- .1 Insert the aluminum vent sleeve over the plumbing components penetrating the roof membrane
- .2 Adhere the flexible deck flange to the base sheet membrane. Apply pressure over the whole surface using a membrane roller. Seal the perimeter of the of the deck flange.
- .3 Insulate the space between the plumbing vent system and the aluminum sleeve.
- .4 Insert and position the adjustable flashing into the aluminum vent sleeve.
- .5 Heat weld the cap sheet membrane on the roof drain deck flange. Allow to cool.
- .6 Install and secure the aluminum rain cap on the aluminum vent sleeve.
- .5 Expansion joints: install expansion joints in accordance with manufacturers instructions.
  - .1 Identify the installation starting point of the expansion joint. Unroll the entire roll before installation to ensure positioning and measurements are accurate.
  - .2 Heat the base sheet on and unroll the expansion joint into the liquefied bitumen of the base sheet. Apply pressure to ensure embedment. Weld a minimum of 150 mm reinforcing strip centered on the edge of the flange and apply pressure to the surface.
  - .3 Cover the flanges with a cap sheet membrane all the way up to the edge of the core and apply pressure to the surface.
  - .4 Cover with a cap sheet of at least 330 mm centered over the joint and fixed on one side to allow expansion movements.
- .6 Pitch pocket: install pitch pockets in accordance with manufacturers instructions.
  - .1 Ensure that surfaces are clean, dry and free of debris, dust, non-adhered particles, oil, corrosion, condensation or other contaminants.
  - .2 Clean metal surfaces and PVC pipes with non greasy solvents, such as acetone or methyl ethyl ketone (MEK).
  - .3 Lay out the precast blocks around the penetration so as to ensure a minimum gap of 25 mm between the block inner wall and the penetration.
  - .4 Seal the base of each penetration with sealant and adhesive. Cover the penetration with sealant at least 25 mm above the height of the precast blocks.
  - .5 Place and align the precast blocks. Apply pressure on the precast blocks until product overflows from all sides of the precast blocks.
  - .6 For horizontal surfaces, completely fill the configuration with the sealing mastic.

### **3.011 STONE BALLAST**

- .1 Apply stone ballast, dry, as soon as possible after completion of membrane and flashings at minimum rate of 50 kg per square meter or of sufficient thickness to completely conceal the membrane.
- .2 Spread stone ballast to an even thickness over entire roof area. Spread additional stone ballast around perimeter of roof for width of 1200 mm to increase ballast weight to 100 kg per square metre.

### **3.012 FIELD QUALITY CONTROL**

- .1 Inspection and testing of roofing application will be carried out by testing laboratory designated by Consultant.
- .2 Consultant will pay for tests.

### **3.013 CLEANING**

- .1 Remove bituminous markings from finished surfaces.

- .2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their written instructions.
- .3 Repair or replace defaced or disfigured finishes caused by work of this section.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 06 10 00 - Rough Carpentry.
- .2 Section 07 21 13 - Board Insulation.
- .3 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .4 Section 07 92 10 - Joint Sealants.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM D412-15a. Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .2 ASTM D624-00(2012). Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
  - .3 ASTM D816-06(2011). Standard Test Methods for Rubber Cements.
  - .4 ASTM D3786/D3786M-13. Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.
  - .5 ASTM D4491/D4491M-15. Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .6 ASTM D4632/D4632M-15a. Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - .7 ASTM D4637/D4637M-15. Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane.
  - .8 ASTM D4751-12. Standard Test Method for Determining Apparent Opening Size of a Geotextile.
  - .9 ASTM D6241-14. Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
- .2 Canadian Roofing Contractors Association (CRCA).
  - .1 Roofing Specifications Manual - 2012.

**1.03 PERFORMANCE REQUIREMENTS**

- .1 Compatibility between components of roofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in this system, meet this requirement.
- .2 Design roof systems as inverted insulated and ballasted assemblies as follows:
  - .1 System R4: inverted, insulated, protected membrane, ballasted over a concrete deck.
    - .1 Concrete deck.
    - .2 Primer. Applied at perimeter and penetrations for membrane terminations and flashings.
    - .3 EPDM membrane. Loose laid with fixed perimeter terminations and flashings.
    - .4 Drainage board.
    - .5 Insulation. 2 layers. Loose laid.
    - .6 Geotextile protection mat. Loose laid over insulation.

- .7 Gravel ballast.
- .2 System R5: inverted, insulated, protected membrane, planted system over a concrete deck.
  - .1 Concrete deck.
  - .2 Primer. Applied at perimeter and penetrations for membrane terminations and flashings.
  - .3 EPDM membrane. Loose laid with fixed perimeter terminations and flashings.
  - .4 Drainage board.
  - .5 Insulation. 2 layers. Loose laid.
  - .6 Filter fabric.
  - .7 Planting medium.

#### 1.04 SUBMITTALS

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of current technical data sheets for each roofing component. Include materials' physical properties, performance criteria, physical size, finish and limitations.
- .3 Submit Material Safety Data Sheets. Indicate VOC content for: primers, adhesives, sealers and membranes.
- .4 Submit shop drawings indicating details and layouts for control joints and insulation.
- .5 Provide details for flashings, control joints, penetrations, field fabricated seams and details.
- .6 Submit 2, one litre sized cans of stone ballast. Submit 2, one litre sized cans of planting medium.
- .7 Submit manufacturer's installation instructions. Indicate special precautions required for sealing the membrane joints. Indicate acceptable installation temperatures and special installation conditions for each product.
- .8 Sustainable Design Submittals LEED. Submit documentation in accordance with Section 01 35 21 - LEED Requirements.
- .9 Provide maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

#### 1.05 QUALITY ASSURANCE

- .1 Submit laboratory test reports in accordance with Section 01 45 00 - Quality Control.
- .2 Submit Manufacturer's Certificate, certifying that products meet or exceed specified requirements.
- .3 Submit laboratory test reports certifying compliance of membranes with specification requirements.
- .4 Convene pre-installation meeting one week prior to beginning Work, with roofing contractor, Contractor and Consultant. Meeting to verify the following requirements:
  - .1 Review installation and substrate conditions.
  - .2 Determine co-ordination with other building subtrades.
  - .3 Review manufacturer's installation instructions and warranty requirements.
- .5 Installer qualifications: company or person specializing in application of inverted EPDM roofing systems. Roofing contractors and sub contractors must be registered with membrane manufacturer's Quality Assurance program. Submit a written certificate issued by membrane manufacturer before beginning any roofing work.



**1.06 DELIVERY STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements
- .2 Handle roofing materials in accordance with manufacturer's written directives to prevent damage or loss of performance.
- .3 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of sealing compounds, primers and caulking materials.
- .4 Provide and maintain dry, off-ground weatherproof storage. Store insulation protected from daylight, weather, and deleterious materials. Store and protect membranes as recommended by Manufacturer.
- .5 Store sealants at plus 5 degrees C minimum.
- .6 Remove only in quantities required for same day use.
- .7 Place plywood runways over completed Work to enable movement of material and other traffic.

**1.07 PROTECTION**

- .1 Fire extinguishers: maintain one cartridge operated type or stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection. Minimum size: 14 kg or as permitted by Consultant.
- .2 Maintain fire watch for 2 hours after each day's roofing operations cease.
- .3 At the end of each workday, use a heat detector gun to spot any smoldering or concealed fire.

**1.08 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove for reuse and return to by manufacturer, all pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .2 Collect and separate for disposal steel, paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal materials from landfill to recycling facility as approved by Consultant. Fold up metal banding, flatten and place in designated area for recycling.
- .4 Hazardous Materials: All hazardous materials which cannot be reused are regarded as hazardous products and are subject to regulations for disposal. Safely store materials defined as hazardous or toxic waste, including emptied containers and application apparatus in containers or areas designated for hazardous waste and dispose of contaminants in an approved legal manner. Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

**1.09 ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install roofing when temperature remains below minus 10 degrees C and to manufacturers' recommendations. Minimum temperature for solvent based adhesives: plus 5 degrees C.
- .2 Install roofing on dry deck, free of snow and ice. Use only dry materials and apply only during weather that will not introduce moisture into roofing system.

**1.010 WARRANTY**

- .1 Membrane: Provide a written and signed document from the membrane manufacturer. Provide Warranty in the owner's name, certifying that the roofing membranes are free of manufacturing defects for a period of ten years, starting from the date of completion of membrane installation. Warranty will cover the removal and replacement of defective roof membrane products, including workmanship. Warranty to remain full and complete for the duration of the period specified. The warranty certificate must reflect these requirements.
- .2 Workmanship. Provide a warranty certificate from the contractor. Provide a written and signed document in the owner's name certifying that the work executed will remain in place and free of waterproofing defect for a 2 year period starting from the date of acceptance.

**Part 2 Products**

**2.01 ADHESIVES**

- .1 Primer: by membrane manufacturer. Primer designed to enhance the adhesion of adhesive used to secure membranes to concrete or wooden substrates. Rated for application at minimum temperature of minus 10 degrees C.
- .2 Bonding adhesive: by membrane manufacturer. Cold applied, solvent based, contact adhesive consisting of a blend of Polychloroprene and SBR rubbers. Designed specifically for bonding EPDM membranes and EPDM flashings to concrete, wood, metal, masonry and other acceptable prepared substrates.

**2.02 MEMBRANES**

- .1 Ethylene propylene Diene monomer (EPDM) sheet membrane: to ASTM D4637, Type 1 non-reinforced for use in low slope, protected systems. Fire retardant, single ply EPDM membrane panel with seam tape factory laminated continuously along one length of the panel. Membrane properties as follows:
  - .1 Thickness: to ASTM D412. 60 mil. 1.499 mm.
  - .2 Tensile strength: to ASTM D412 (Die C). 1454 psi (10.0 MPa).
  - .3 Ultimate elongation: to ASTM D412 (Die C). 622 %.
  - .4 Tear resistance: to ASTM D624 (Die C). 219 kN per metre.
  - .5 Seam tape. Factory applied adhesive seam tape. Black rubber polymer base. Solvent free, 100 % solids, cured rubber. Thickness: 0.89 mm. plus/minus 0.20 mm. Width: 152 mm. Factory seam strength: to ASTM D816, Method B (Modified). Passed: sheet failure.
- .2 Flashing membrane: self-curing, EPDM based membrane for use as flashing as recommended by the membrane manufacturer.

**2.03 DRAINAGE BOARD**

- .1 By membrane manufacturer. 12.5 mm thick, engineered, high flow, dimpled drainage board. Manufactured from 100 % post consumer recycled, high density polypropylene. Provide with filter fabric bonded to the top, and a non woven geotextile bonded to the underside. Properties as follows:
  - .1 Roll dimensions: 1.2 x 15.200 meters.
  - .2 Dry weight: 22.7 kg per roll.
  - .3 Compressive strength: 15000 pounds per square foot.
  - .4 Flow rate (core): 21 gallons per minute per foot.

- .5 Flow rate (fabric): 250 gallons per minute per square foot.

## **2.04 FILTER FABRIC**

- .1 UV resistant, highly permeable, non-woven, needle punched polypropylene fiber geotextile. Designed to keep growing media in place, and prevent plant roots from intruding into the insulation. The non-woven fiber allows movement of water and air throughout the vegetative roof system. Properties as follows:
  - .1 Roll dimensions: 600 mm x 110 meters.
  - .2 Grab strength: to ASTM D4632/D4632M. 80 pounds per foot.
  - .3 Water flow: to ASTM D4491/D4491M. 160 gallons per minute per square foot.
  - .4 Apparent opening size: to ASTM D4751. 0.0085 inches.
  - .5 Thickness: 45 mil.
  - .6 Fabric weight: 3.2 ounces per square yard.

## **2.05 GEOTEXTILE PROTECTION MAT**

- .1 Black, synthetic, non-woven, needle-punched, geotextile fabric. Designed as a protection mat installed above the insulation to protect it from the stone ballast. Properties as follows:
  - .1 Nominal weight: 154 grams per square metre.
  - .2 Tensile strength (Grab): to ASTM D4632/D4632M. 80.7 kg.
  - .3 Burst strength: to ASTM D3786/D3786M. 2310 kPa.
  - .4 Permeability: to ASTM D4491/D4491M. 0.57 cm per second.
  - .5 CBR puncture: to ASTM D6241. 141 kg.
  - .6 Roll dimensions: 4.6 m x 97.5 m.
  - .7 Weight: 81.7 kg per roll.

## **2.06 INSULATION**

- .1 Insulation: XPS insulation as specified in Section 07 21 13 - Board Insulation. Provide in two separate layers.

## **2.07 CARPENTRY**

- .1 Fascia, curbs cant strips and blocking: construct from pressure treated lumber and plywood materials as specified in Section 06 10 00 - Rough Carpentry. Construct to sizes and details as indicated and to match on site conditions as required.

## **2.08 ROOFING ACCESSORIES**

- .1 Expansion joint membrane: expansion joint designed to provide simultaneous 3 dimensional movements. As recommended by membrane manufacturer.
- .2 Roof Drain: as recommended by membrane manufacturer. Designed specifically for installation in a protected EPDM membrane roof assembly.
- .3 Vent flashing: prefabricated flashing assembly consisting of a flexible deck flange made from EPDM membrane crimped to an aluminum sleeve designed to ensure watertightness around plumbing vents on roofs with an EPDM membrane. Sizes to suit.

## **2.09 SEALANTS**

- .1 Sealants: as specified in Section 07 92 10 - Joint Sealants.

- .2 Waterproofing mastic and sealing compound: as recommended by membrane manufacturer for specific uses as designed.

**2.010 BALLAST**

- .1 White roofing stone: Calcite/marble: graded from 20- 40 mm size, well graded. Washed, free from fines, long splinters, moisture, ice and snow.

**2.011 PLANTING MEDIUM**

- .1 Engineered planting medium. Topsoil mix: friable loam with an organic content of 6 - 8%. Weed, stone and herbicide free. Obtain a complete soil analysis from an approved laboratory. Analysis to include major and minor elements, pH, and texture. Prepare recommendations for amendment to establish an optimum environment for healthy native plant growth and submit the results for approval. Maximum pH 7.0.
- .2 Fertilizer: organic based granular fertilizer; analysis based on the results of the soil tests.

**Part 3 Execution**

**3.01 WORKMANSHIP**

- .1 Do examination, preparation and roofing Work in accordance with the membrane manufacturer's written instructions and CRCA Roofing Specification Manual.
- .2 Do priming in accordance with manufacturers written recommendations.
- .3 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

**3.02 PROTECTION**

- .1 Cover walls, walks, sloped roofs and adjacent work where materials hoisted or used.
- .2 Use warning signs and barriers. Maintain in good order until completion of Work.
- .3 Clean off drips and smears immediately.
- .4 Dispose of rain water off roof and away from face of building until roof drains or hoppers are installed and connected.
- .5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Consultant. Place plywood runways over work to enable movement of material and other traffic. Seal and ballast exposed edges.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

**3.03 EXAMINATION OF ROOF DECKS**

- .1 Examine roof decking and immediately inform Consultant in writing of any defects. Inspect condition of deck with Consultant, including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed. Do not proceed with installation of new roofing until Consultant has approved condition of deck.
- .2 Prior to beginning of work ensure:
  - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
  - .2 Curbs have been built.

- .3 Roof drains have been installed at proper elevations relative to finished roof surface.
- .4 Plywood and lumber nailer plates have been installed to deck, walls and parapets.
- .5 Ensure that the intersection between the wall and roof assembly is prepared and sealed with a durable, rigid material to create a connection point for the transition membrane connecting the wall air barrier to the roof membrane.
- .3 Do not install roofing materials during rain or snowfall.

### **3.04 PREPARATION OF CONCRETE DECK**

- .1 Prepare surfaces of concrete deck as recommended by membrane manufacturer. Ensure that concrete deck surfaces are acceptable to the membrane manufacturer.
- .2 Ensure surfaces are clean, smooth, dry, free of sharp edges, loose and foreign materials, oil, grease, and other contaminants.
- .3 Repair all roughened surfaces that can damage the membrane to ensure a smooth substrate. Fill any surface voids greater than 6 mm wide with a concrete patching product acceptable to membrane manufacturer.

### **3.05 CURBS AND NAILERS**

- .1 Construct curbs and nailers as detailed. Provide continuous curbs at perimeter for fastening of membrane and flashings in accordance with applicable CRCA flashing details.

### **3.06 BONDING ADHESIVE**

- .1 Prepare surfaces to receive EPDM bonding adhesive.
- .2 Prime all horizontal and vertical surfaces scheduled to receive membrane and membrane flashings and allow to thoroughly dry before applying bonding adhesive.
- .3 Prepare and apply the bonding adhesive in accordance with manufacturers written instructions to achieve 100 % coverage. Apply by rolling the adhesive on both mating surfaces evenly so as to avoid globs or puddles.
- .4 Extend membrane up vertical surfaces and over transition membranes to ensure positive and continuous contact with wall air barrier.

### **3.07 MEMBRANE APPLICATION: LOOSE LAID INVERTED ASSEMBLY**

- .1 Apply membrane to properly prepared concrete deck as follows:
  - .1 Position membrane over substrate starting at highest point.
  - .2 Unroll and position the membrane so field seams form in shingle fashion, generally in the direction of water moving towards the drains and with finished lap edges facing down slope.
  - .3 Allow membrane to relax.
  - .4 Create side lap seams and end lap seams as recommended by membrane manufacturer.
  - .5 Install membrane and flashings as recommended by membrane manufacturer.
- .2 Joints: Seal all joints and seams as recommended by membrane manufacturer.
  - .1 For factory applied seam tape, clean mating surfaces and seal side lap joints.
  - .2 For end joints, clean mating surfaces, apply primer and splicing cement.
  - .3 Complete seams along the panel widths and any cut or trimmed membrane edges.

- .3 Edge securement: adhere membrane to substructure at perimeter of roof as recommended by membrane manufacturer.
- .4 Flashings: construct flashings and secure membrane and flashings to their support without sags, blisters, fishmouths or wrinkles. Prepare flashings for installation of pre-finished metal cap flashings as specified in Section 07 62 00 - Sheet Metal Flashing and Trim.
- .5 Penetrations: install drain pans, vent stack covers and other penetration flashings and seal to membrane.
- .6 Application to be free of blisters, wrinkles and fishmouths.

### **3.08 DRAINAGE BOARD**

- .1 Install drainage board to top surface of EPDM membrane.
- .2 Unroll board ensuring top side faces up. Overlap the selvedge edge of both the top and underside fabrics at panel sides.
- .3 Cut panels to allow for hold back space around deck penetrations and drains. Install strips of filter fabric to extend from top surface of the drainage board to the top edge of the membrane at perimeter and all penetrations. Extend strips of the filter fabric 600 mm horizontally onto the top surface of the drainage board and extend a minimum of 300 mm above the intended top of the growing media where planting medium is to be installed above the insulation.

### **3.09 INSULATION**

- .1 Place insulation boards in 2 separate layers on top of drainage board. Install with parallel rows with all edges and ends staggered and in firm contact with one another. Cut end pieces to suit. Offset joints in both directions between first and second layers.

### **3.010 FILTER FABRIC**

- .1 Install filter fabric unbonded above insulation where a planting medium will be installed above.
- .2 Unroll fabric on roof, overlapping panels minimum 900 mm at all sides and ends.
- .3 Extend fabric a minimum of 300 mm above the top surface of the planting media.
- .4 Cut fabric around drains, vents and other penetrations and extend under metal flashings.

### **3.011 PLANTING MEDIUM**

- .1 Install planting medium on top of filter fabric to depth as indicated in the drawings.
- .2 Moderately compact planting medium to ensure stability and prevent erosion caused by wind or rainfall.

### **3.012 GEOTEXTILE PROTECTION MAT**

- .1 Install geotextile protection mat unbonded above insulation where stone ballast will be installed above.
- .2 Unroll the protection mat. Install with 100 mm side laps and 200 mm end laps.
- .3 Extend mat up penetrations and vertical surfaces past the height of gravel a minimum of 50 mm.
- .4 Cut fabric around drains, vents and other penetrations and extend under metal flashings. Install an additional piece of mat around penetrations and where mat is cut. Overlap a minimum of 200 mm.

- .5 Install grave ballast as soon as mat is positioned to protect against mat movement and sunlight.
- .6 Ensure that the protection mat is completely covered with gravel by the end of each working day.
- .7 Ensure that sufficient ballast is installed to completely cover the protection mat and protect against UV degradation.

### **3.013 INSTALLATION OF ACCESSORIES**

- .1 Install roof drains, pans, covers expansion joints and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.
- .2 Vent stack flashing: install flashing in accordance with manufacturers instructions.
  - .1 Insert the aluminum vent sleeve over the plumbing components penetrating the roof membrane
  - .2 Insulate the space between the plumbing vent system and the aluminum sleeve.
  - .3 Insert and position the adjustable flashing into the aluminum vent sleeve.
  - .4 Seal the membrane to the roof drain deck flange.
  - .5 Install and secure the aluminum rain cap on the aluminum vent sleeve.

### **3.014 STONE BALLAST**

- .1 Apply stone ballast, dry, as soon as possible after completion of protection mat and flashings at minimum rate of 50 kg per square meter or of sufficient thickness to completely conceal the protection mat.
- .2 Spread stone ballast to an even thickness over entire roof area. Spread additional stone ballast around perimeter of roof for width of 1200 mm to increase ballast weight to 100 kg per square metre.

### **3.015 FIELD QUALITY CONTROL**

- .1 Inspection and testing of roofing application will be carried out by testing laboratory designated by Consultant. Consultant will pay for tests.

### **3.016 CLEANING**

- .1 Clean work area daily in accordance with Section 01 74 11 - Cleaning.
- .2 Remove markings from finished surfaces.
- .3 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their written instructions.
- .4 Repair or replace defaced or disfigured finishes caused by work of this section.
- .5 Clean to Consultant's approval any soiled surfaces, spatters or damage caused by Work of this Section.
- .6 Check drains to ensure cleanliness and proper function, and remove debris, equipment and excess material from site.
- .7 On completion of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 92 00 - Joint Sealants.

**1.02 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME).
  - .1 ASME B18.6.4-1998 (R2005). Thread Forming And Thread Cutting Tapping Screws And Metallic Drive Screws - Inch.
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A653/A653M-15e1. Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM A792/A792M-10(2015). Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .3 ASTM D523-14. Standard Test Method for Specular Gloss.
  - .4 ASTM D2244-16. Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
  - .5 ASTM D2247-15. Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity.
  - .6 ASTM D3363-05(2011)e2. Standard Test Method for Film Hardness by Pencil Test.
  - .7 ASTM D4214-07(2015). Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
  - .8 ASTM D4869/D4869M-16a. Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
  - .9 ASTM E96/E96M-16. Standard Test Methods for Water Vapor Transmission of Materials.
- .3 Canadian Roofing Contractors Association (CRCA).
  - .1 Roofing Specifications Manual 2012.

**1.03 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature for sheet metal materials. Provide datasheets including product characteristics, performance criteria and specifications for factory applied finishes.
- .3 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, colour and finish.
- .4 Submit two copies WHMIS MSDS - Material Safety Data Sheets.
- .5 Sustainable Design Submittals. Provide Submittals in accordance with Section 01 35 21 - LEED Requirements.
- .6 Submit manufacturer's installation instructions, special handling criteria and cleaning procedures.



**1.04 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Fold up metal banding, flatten and place in designated area for recycling. Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

**Part 2 Products**

**2.01 SHEET METAL MATERIALS**

- .1 Aluminum-zinc alloy-coated steel to ASTM A792/A792M. Commercial Steel. Coating Designation AZM 180 (AZ60). Coating Mass: 180 grams per square meter. Coating thickness: 0.048 mm. Extra smooth surface finish. Minimum thickness 20 ga (0.866 mm) or as indicated in the drawings.

**2.02 PREFINISHED STEEL SHEET**

- .1 Pre-Painted Galvanized sheet steel to ASTM A653/A653M G90 or Galvalume coated steel to ASTM A792/A792M. Minimum base steel thickness: 0.866 mm (20 ga). Overall thickness including coatings: 0.939 mm. Coated both sides. Unexposed surface to manufacturer's standard.
  - .1 Factory prefinished with polyvinylidene fluoride (PVDF) paint. 2 coat paint system consisting of a corrosion inhibiting primer and topcoat based on minimum 70% Kynar 500 or Hylar 5000 resin technology.
  - .2 Minimum coating thickness: 0.025 mm (0.9 mils ). Consisting of 0.7 mil topcoat DFT and 0.2 mil primer DFT. Finished both sides.
  - .3 Colour as selected by Consultant from full and extended range of available colours.
  - .4 Film Hardness: to ASTM D3363. HB-2H.
  - .5 Specular gloss: to ASTM D523. 25 +/- 5 units.
  - .6 Humidity Resistance: to ASTM D2247. Minimum 1500 hours at 100 RH.
  - .7 Chalking: to ASTM D4214 Method A. maximum rating of no. 8 after 30 years.
  - .8 Colour change: to ASTM D2244. Maximum change of 5 colour units after 30 years.
  - .9 Fasteners, self drilling cap screws with nylon caps and rubber washers of same colour as sheet metal being secured. Length and thickness suitable for metal flashing application.
  - .10 Touch-up paint: as recommended by prefinished material manufacturer.

**2.03 ACCESSORIES**

- .1 Underlay for metal flashing: vapour permeable membrane: Polypropylene vapour permeable, weather resistive roofing underlayment membrane. Minimum moisture vapour transmission rate of 59 perms (3392 ng/Pa/s/m2) as per ASTM E96. Minimum thickness: 0.5 mm. Ultraviolet stabilized. Liquid water transmission: to ASTM D4869/D4869M: pass. Provide seaming tape and sealant as per membrane manufacturer.
- .2 Sealants: as specified in Section 07 92 00 - Joint Sealants.

- .3 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .4 Fasteners: self drilling cap screws to ANSI B18.6.4. Purpose made cadmium plated steel complete with Galvalume caps or prefinished nylon caps to match flashing finish. Provide neoprene washers. Suitable length and diameter as required to penetrate minimum 12 mm into framing. Use fasteners of a size suitable for the particular fastening condition and service as specified.
- .5 Touch-up paint: as recommended by sheet steel manufacturer.

## **2.04 FABRICATION**

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as detailed.
- .2 Fabricate metal flashings and other sheet metal work as per accepted mock-up, and in accordance with CRCA FL series details and as indicated in the drawings.
- .3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.
- .4 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.
- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

## **2.05 PANS**

- .1 Form pans to receive roofing plastic from aluminum - zinc coated 20 gauge sheet steel with minimum 75 mm upstand above finished roof and 100 mm continuous flanges with no open corners. Solder joints. Make pans minimum 100 mm wider than member passing through roof membrane.

## **2.06 SCUPPERS**

- .1 Form scuppers from prefinished sheet steel in accordance with CRCA FL series details. Sizes and profiles as indicated. Provide necessary fastenings.

## **2.07 FLASHINGS**

- .1 Where components are visible from the ground and where indicated in the drawings, form profiles indicated from prefinished sheet steel. Fabricate cap flashings, reglets, copings and fascias to shapes sizes and profiles as indicated in the drawings. Fabricate interlocking seams at joints as detailed and prepare seams.
- .2 Where components are not visible, form to shapes, sizes and profiles as indicated from aluminum - zinc coated sheet steel.
- .3 Hem exposed edges on underside 12 mm.
- .4 Fabricate corners from one piece with minimum 450 mm long legs each direction. Form interlocking joints and seal with sealant.
- .5 Fabricate vertical faces with bottom edge formed outward 6 mm and hemmed to form drip.
- .6 Form recessed reglets, surface mounted reglets, and metal cap flashings in accordance with CRCA FL series details. Provide slotted fixing holes and steel/plastic washer fasteners. Cover face and ends with plastic tape.
- .7 Form components to ensure that raw edges of sheet metal are not left exposed.
- .8 Sizes and profiles to suit unless otherwise detailed or indicated.

**Part 3            Execution**

**3.01            INSTALLATION**

- .1      Install new sheet metal work in accordance with CRCA FL series details and as detailed.
- .2      Use concealed fastenings except where approved before installation.
- .3      Provide underlay under sheet metal. Secure in place and lap joints 100 mm.
- .4      Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips or as detailed.
- .5      For prefinished steel flashings, lock end joints and caulk with sealant. Install matching colour prefinished cap screws where exposed fastening is required.
- .6      Insert metal flashing under cap flashing to form weather tight junction.
- .7      Lock end joints and caulk with sealant.
- .8      Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .9      Insert metal flashing into reglets, under cap flashing to form weather tight junction.
- .10     Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
- .11     Caulk flashing at reglet cap flashing with sealant.
- .12     Install pans, where shown around items projecting through roof membrane.

**3.02            SCUPPERS**

- .1      Install scuppers as indicated.

**3.03            CLEANING**

- .1      Provide daily cleaning in accordance with Section 01 74 11 - Cleaning.
- .2      On completion of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3      Leave work areas clean, free from grease, finger marks and stains.

**END OF SECTION**

**Part 1 General**

**1.01 GENERAL DESCRIPTION**

- .1 This section specifies firestopping material and/or systems intended to act as a fire stop and smoke seal system to protect against the passage of fire, hot gases and toxic smoke within fire separation for the Fire Resistance Rating of a wall, floor, ceiling or roof assemblies for any through-penetration item, membrane penetration poke-through termination device, blanks, gaps, voids or any un-penetrated joint or opening, to form a draft-tight barrier within or between construction assemblies and act to retard the passage of flame, smoke and toxic gases.
- .2 Provide fire and smoke stop systems consisting of a material, or combination of materials installed to maintain the integrity of the Fire Resistance Rating of the fire separation by maintaining an effective barrier against the spread of flame, smoke, heat and / or hot gases through penetrations, blank openings, construction joints, or at perimeter fire containment in or adjacent to the Fire Separation in accordance with the requirements of the National Building Code.
- .3 Subject to point 1.05 below, only tested fire and smoke stop systems shall be used in specific locations as follows and also as indicated in the schedule of Firestop locations.
  - .1 Service Penetrations for the passage of duct, cable tray, conduit, piping, electrical bus ways and raceways, empty / blank openings through vertical fire separations (walls and partitions), horizontal that have a fire separation (floor/ceiling assemblies), and vertical service fire separation shaft walls and partitions.
  - .2 Safing slot gaps between edge of floor slab fire separations and curtain walls.
  - .3 Openings between structurally separate sections of walls or floors that have a fire separation.
  - .4 Joints between the bottom of walls or wall-to-wall joints (gypsum board to concrete or concrete block walls).
  - .5 Joints between the top of walls and ceilings or floor and roof assemblies, slip joint or concrete shrinkage joint detail.
  - .6 Mechanical and electrical recessed boxes through fire resistant membranes.
  - .7 Expansion joints in vertical and horizontal fire separations.
  - .8 Systems installed to allow and be designed to accommodate movement (expansion) in all joints as indicated on architectural / structural drawings/specifications and plumbing pipes and sprinkler pipes that require movement during the activation of these systems.
  - .9 Openings around structural members, which penetrate horizontal and vertical fire separations and their fire resistant membranes.
- .4 All firestopping systems to have F rating at least equal to that of the separation in which they are installed.
- .5 All multiple service penetration through a fire separation must have a minimum space between penetrants equal to the size of the bigger adjacent penetrant and not less than 50 mm, to be considered an individual services penetration. Penetrations where the space between penetrating items is less than 50 mm or less than the size of the bigger adjacent penetrant will be classified as multi-penetrations and a rectangular framed out opening shall be constructed as detailed around the penetrations with a fire and smoke stop system applied to the entire opening.

**1.02 DEFINITIONS**

- .1 Firestops: specially tested materials or combination of materials used to establish or re-establish the integrity of a fire rated wall, floor, ceiling or roof assembly or other partition after the

structure has been breached for the through-penetration of building service items or to close off openings left due to construction methods to prevent or limit the spread of fire, heat, gasses and smoke.

- .2 Through-penetration: opening or foreign material, pipes, conduits, ducts, cable trays, cable, wire, structural components or any other element passing completely through an opening in a fire rated barrier/assembly such that the full thickness of the rated material is breached either in total or in part.
- .3 Membrane penetration: any penetration of a fire rated barrier that breaches one side but does not pass completely through to the other side, including recessed electrical devices.
- .4 System: the combination of specific materials and/or devices, including the penetrating items required to complete the Firestop, as tested by an independent third party test facility.
- .5 Barrier/Assembly: a wall, floor, ceiling or roof assembly or other partition with a fire-smoke rating of 0,1, 2, 3 or up to 4 hours.
- .6 Fire Resistive Joint: any joint or opening, whether static or dynamic, within or between adjacent sections of fire rated interior or exterior walls, floors, ceilings or roof decks.
- .7 Fireblocking: Building materials installed to resist the free passage of flame, smoke and noxious gases to other areas of the building through concealed spaces.
- .8 Perimeter Fire Barrier System: The perimeter joint protection that provides fire resistance to prevent the passage of fire from floor to floor within the building at the opening between the exterior wall assembly and the floor assembly.
- .9 Intumescent: Materials that expand with that to seal around objects threatened by fire.
- .10 F-Rating: the time a Firestop, penetrating item, building, material, Firestop material, can withstand direct flame without a burn through as tested to CAN4-S115 /ULC-S115 or ASTM E814/UL 1479.
- .11 T-Rating: the amount of time a through-penetration Firestop limits the temperature rise on the cold side-outside the test furnace as tested to CAN4-S115 /ULC-S115 or ASTM E814/UL 1479.
- .12 L-Rating Water Leakage Test: introduced by Underwriters Laboratories on August 9, 2004 for systems tested and listed in accordance with ANSI/UL 1479.
- .13 Non-Rated Partitions (N): A separation that prevents the passage of sound. For the purpose of this project to address acoustic separation requirements, all Non-Rated partitions as indicated on drawings to be assigned an assembly equal to a minimum time of 60 minutes Fire Resistance Rating and shall be fire stopped on both sides of the fire separation.
- .14 Single Penetration: one service penetration through a fire separation.
- .15 Multi-Penetration: two or more service penetrations through a fire separation where the space between penetrants is equal or greater than the size of the bigger adjacent penetrant without being less than 50 mm (Example, one, 100 mm diameter pipe and one 150 mm diameter pipe, the space between pipes must be greater than 150 mm or otherwise the penetration will be considered a multi-penetration, when passing through a fire rated assembly.)

### 1.03

#### REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM E84-13a. Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .2 ASTM E119-12a. Standard Test Methods for Fire Tests of Building Construction and Materials.

- .3 ASTM E814-13a. Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .4 ASTM E1399/E1399M-97(2013)e1. Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.
- .5 ASTM E1966-07(2011). Standard Test Method for Fire-Resistive Joint Systems.
- .6 ASTM E2174-10ae1. Standard Practice for On-Site Inspection of Installed Fire Stops.
- .7 ASTM E2307-10. Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus.
- .8 ASTM E2393-10a. Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- .2 Factory Mutual Research Corporation (FM).
  - .1 FM 4991-2014. Standard for the Approval of Firestop Contractors Information and FCIA Member, FM Approved Contractor List.
- .3 Underwriter's Laboratories of Canada (ULC).
  - .1 CAN-ULC-S101-07. Standard Methods of Fire Endurance Tests Of Building Construction And Materials.
  - .2 CAN-ULC-S102-10. Standard Method of Test For Surface Burning Characteristics Of Building Materials And Assemblies.
  - .3 CAN/ULC-S115-11. Standard Method of Fire Tests of Firestop Systems
- .4 Underwriters Laboratories (UL).
  - .1 UL 1479-2012. Standard for Fire Tests of Through-Penetration Firestops.
  - .2 UL 2079-2012. Standard for Tests for Fire Resistance of Building Joint Systems.
- .5 International Firestop Council (IFC).
  - .1 Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs).
  - .2 Recommended IFC Guidelines For Evaluating Engineering Judgments on Fire Resistant Duct Enclosure Systems for Ventilation Ducts.
- .6 Firestop Contractors International Association (FCIA).
  - .1 M.O.P. Manual of Practice.
- .7 National Research Council of Canada. (NRC).
  - .1 Best Practice Guide On Firestops and Fire Blocks and Their Impact On Sound Transmission, 2007.
- .8 National Fire Protection Association (NFPA).
  - .1 NFPA 101-2012. Life Safety Code.

#### 1.04 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 All submissions to include only the most current literature that has been updated by the Manufacturer on a regular basis. The submitted literature must bear a date that is less than 24 months old.
- .3 Submit Manufacturer's printed product data sheets. Submit complete product data sheet for each individual component. Provide a comprehensive list and indicate the following properties for each component:

- .1 Product name and Product number.
- .2 Product characteristics and performance criteria.
- .3 Physical size , finish and limitations.
- .4 Technical data on out-gassing, off-gassing and age testing.
- .5 Curing time.
- .6 Chemical compatibility to other construction materials.
- .7 Shelf life (expiry date).
- .8 Life expectancy.
- .9 Temperature range for installation.
- .10 Humidity range for installation.
- .4 Submit Material Safety Data Sheets for each product.
- .5 Submit Certification by the Manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's) and are non-toxic to building occupants.
  - .1 Submit test reports showing compliance to ASTM E595.
  - .2 Test Method: Environmental Protection Association, EPA Method 24.
  - .3 Indoor Environmental Quality: Volatile Content: below 250 g/l.
  - .4 Do not use silicone Firestops.
- .6 Submit Shop Drawings to show location of proposed material, reinforcement, anchorage, fastenings and method of installation. Indicate typical construction details to accurately reflect actual job conditions for each product and assembly. Submit details for materials and prefabricated devices. Provide descriptions complete and sufficient for identification at job site.
  - .1 Bind shop drawings in hard covered three D-ring binders sized for 215 x 280mm size paper. Binders not to be more than 2/3 full.
  - .2 Include a title sheet, labelled "Fire and Smoke Stop System Drawing Design System Listings". Include project name, date and installation company name and Manufacturer of products name. Insert title in front and spine of binder.
  - .3 Provide a Table of Contents at the front of each binder.
  - .4 Provide a list of each proposed Design Listing and corresponding service penetration type or joint type in a matrix spreadsheet schedule, indicating floor and wall system, including rating for each.
  - .5 Provide a list of each proposed Design Listing with approximate total quantity or amounts of each listing per floor on separate sheet.
  - .6 Number each penetration corresponding to the exact same number of the plate penetration number.
  - .7 Organize each floor, wall and ceiling area indicating each room number, labelled with tabs of celluloid covers fastened to hard paper dividing sheets.
  - .8 Provide copies of all fire and smoke stop system ULC or UL Design No. listings for each penetration type for all areas located.
  - .9 Provide certifications of each installer proposed on working on the Project.
- .7 Submit Test Reports in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics. Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .8 Submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures
- .9 Submit Design System Listings.
  - .1 Indicate proposed material, including technical data, reinforcement, anchorage, fastenings and method of installation. Construction details shall accurately reflect actual job conditions.
  - .2 Provide ULC or UL Design System Listings on each system for each application for each area as indicated.
  - .3 When more than one product is specified for the Firestop Design Listing System or more than one backing/damning material is indicated, identify the item that will be used on this project.
- .10 Submit Samples.
  - .1 Submit duplicate samples of the proposed assembly identification penetration plate.
  - .2 Submit duplicate samples of each type of product in un-opened containers. Include all anchors/fasteners and damming material. Identify each product indicating the shelf life and expiry date. Submit samples no older than 75 % of their expected shelf life.
  - .3 Submit sample mock-ups of each system. Provide mock-up maximum to a maximum size of 600 x 600 mm. Submit to Consultant minimum 1 week prior to commencing on-site work.
- .11 Closeout Submittals: Provide maintenance data for each product for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### 1.05 ENGINEERING JUDGEMENTS

- .1 Where there is no specific tested Design System Listings available from the Manufacturer for a particular Firestop configuration, review systems from all other manufacturers to attempt to obtain a Design System Listing. Provide an Engineering Judgement (EJ) from the system Manufacturer if there are no approved systems. Include in each EJ, a drawing of the proposed system, a description of the system, Project Name and Room Name/Number that the EJ is located in. Include copies of all referenced Design Listings and signed/dated by the Manufacturer's Fire Protection Engineer. Once the EJ has been reviewed, submit the EJ to the Authority Having Jurisdiction for final approval.
- .2 EJ shall be issued in lieu of tested systems when a tested Design Listing is not available for the current on site conditions.
- .3 EJ shall be issued only by Firestop manufacturer's qualified technical personnel or, in concert with the manufacturer, by a knowledgeable registered Professional Engineer, or Fire Protection Engineer, or an independent testing agency that provides listing services for Firestop systems.
- .4 EJ shall be based upon interpolations of previously tested Firestop systems that are either sufficiently similar in nature or clearly bracket the conditions upon which the judgement is to be given. Additional knowledge and technical interpretations based upon accepted engineering principles, fire science and fire testing guidelines (e.g. ASTM E2031 - Standard Guide for Extension of Data from Fire Endurance Tests) may also be used as further support data.
- .5 EJ shall be based upon full knowledge of the elements of the construction to be protected and understanding of the probable behaviour of that construction and the recommended Firestop system protecting it were they to be subjected to the appropriate Firestop Standard Fire Test method for the required fire rating duration.



- .6 EJ shall be limited to the specific conditions and configurations upon which the engineering judgement was rendered and should be based upon reasonable performance expectations for the recommended Firestop system under those conditions.
- .7 EJ shall be accepted only for a single specific job and location and should not be transferred to any other job or location without thorough and appropriate review of all aspects of the next job or location's circumstances.
- .8 EJ's shall be accepted in jurisdictions that permit Alternative Methods per applicable Model Building Code.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Deliver, store and handle materials in accordance with manufacturer's written instructions. Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer and ULC markings.
- .4 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. Replace defective or damaged materials with new.
- .5 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type, and ULC or UL label, complete with batch number, manufacturing date and shelf life expiry date.
- .6 All products that are delivered to site, must have a minimum of 75% of its shelf life still remaining on it, from date of delivery on site, otherwise the product will be rejected and removed from the site.
- .7 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- .8 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.
- .9 Comply with recommended procedures, precautions or remedies described in MSD Sheets.
- .10 Do not use damaged or expired material.

#### **1.07 QUALITY ASSURANCE**

- .1 Firestopping Contractor to have a minimum of 5 years of documented experience in the Firestopping trade utilizing the material and systems as specified in this section. Provide a list of a minimum of 5 successfully completed projects of similar scale and type.
- .2 Firestop contractor to be a member of the Firestop Contractors International Association (FCIA) and be in good standing with this association. Submit written proof of membership to Consultant within 48 hours after award of the project
- .3 Provide Fire Protection Engineering personnel with a minimum 5 years experience on the manufacturer's design systems.
- .4 Provide a letter in writing within 48 hours after award that the Engineered Judgements shall be provided by their Fire Protection Engineer as required to suit building conditions. All Engineered Judgements shall conform to IFC guidelines and the manufacturer shall be a member in good

standing with the IFC or FCIA. Submit proof of membership to the IFC or FCIA within 48 hours after award of the project.

- .5 Provide Manufacturer's qualified representative on site during initial mock-up installation of Firestop systems to ensure the mock-ups have been installed based on the approved design system listings and to train appropriate sub-contractor personnel in proper selection and installation procedures.
- .6 Firestop Systems do not re-establish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- .7 For those Firestop applications that exist for which no ULC or UL tested system is available through a manufacturer, a Manufacturer's Engineered Judgement derived from similar ULC or UL system designs or other tests will be submitted to local Authorities Having Jurisdiction for their review and approval prior to installation. Engineered Judgement drawings must follow requirements set forth by the International Firestop Council Guidelines.
- .8 Provide a single Manufacturer for all products used on this project. Materials of different manufacturers shall not be acceptable, unless the manufacturer cannot provide a design listed system for a particular Firestop installation. Provide products from another manufacturer to avoid providing an Engineer Judgement.

#### **1.08 QUALITY CONTROL**

- .1 Construct Mock-Up of Firestopping products in accordance with Section 01 45 00 - Quality control.
- .2 Prior to commencement of construction, provide Mock-Up of each proposed ULC or UL system for review by Consultant. Mock-Up shall include work by other trades to provide the required finish work, such as steel stud / gypsum board trade framing out multi-penetrations openings.
- .3 Locations for Mock-Up as directed by the Consultant.
- .4 Once Mock-Up has been completed and materials have had adequate time to properly cure, provide minimum of 48 hours written notification to Consultant.
- .5 Reviewed Mock-Up shall become the standards of workmanship and material against which installed work will be checked. Approved Mock-Up may be used in final construction.
- .6 Manufacturer's representative to be present during the review.
- .7 The Consultant may perform Destructive Tests to each Mock-Up to ensure the system meets or exceeds the approved Design System Listing.
- .8 Manufacturer to provide written confirmation that the Firestop systems meets or exceeds the ULC or UL design system listing requirements for each mock-up application.
- .9 Maintain Mock-Up during construction in an undisturbed condition as a standard for judging completed unit of work. Accepted Mock-Up may become part of completed unit of work.

#### **1.09 ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install firestopping when ambient or substrate temperatures are outside limits permitted by Manufacturers or when substrates are wet, due to rain, frost, condensation, or other causes.
- .2 Maintain air temperature and structural base temperature at installation area within range as recommended by Manufacturer for 48 hours before, during and 72 hours after installation.

- .3 Ventilate firestopping per Manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.
- .4 During installation, provide masking and drop sheets to prevent firestopping materials from contaminating any adjacent surfaces.
- .5 Do not use materials that contain flammable solvents.
- .6 Water based products are unacceptable in wet areas or areas that may be subject to occasional flooding.

#### **1.10 PRE-CONSTRUCTION MEETING**

- .1 Consultant will schedule a meeting approximately two weeks prior to the start of the work of this Section with the Contractor and all affected Sub-trades. The purpose of the meeting will be to review the "Standard Construction Project Firestop Guideline".
- .2 All Sub-Trades that are affected, such as the concrete, masonry, window, gypsum board/steel stud, Mechanical (including their Sub-Trades), Electrical (including their Sub-Trades) shall be in attendance, along with Firestopping Contractor.
- .3 Each Sub-Trade shall receive one copy of the Design System Listings Shop Drawings as provided by the Contractor.
- .4 Standard installation procedures shall be reviewed, scheduling / sequencing of other work around or that affects the outcome of the installation, precautions, annular opening sizes, wall/floor service single and multi preparations, joints and perimeter joints shall be reviewed to ensure that all Sub-Trades and the Contractor understand the full complexity of the Firestop installation, based on the approved Design System Listings Shop Drawings.
- .5 Consultant will take minutes of this meeting and distribute these minutes to all affected trades.

#### **1.11 AS-BUILT DOCUMENTATION**

- .1 Submit As-Built records in accordance with Section 01 78 00 - Close Out Submittals.
- .2 Maintain a log of all activities on site during the course of construction. Provide a monthly report at the beginning of every month detailing all firestopping work during the period. Provide a copy of all logs at completion of Firestopping work.
- .3 Provide a copy of As-Built drawings, project manual, schedules and Firestop details.
- .4 Mark up the drawings, schedules and details weekly, showing all alterations, changes and confirmation of each Design Listing in relationship to the project schedules.
- .5 Provide completed Firestopping Schedules for floors, walls and ceilings.
- .6 Indicate all service penetrations or joints through each reference wall, floor and ceiling in the schedules. Record all information, indicate all required descriptions for each column based on the actual on-site condition. Submit schedules to Consultant at the end of the project for maintenance use.

#### **1.12 WARRANTY**

- .1 For the Work of this Section, 07 84 00 - Firestopping, the 12 months warranty period prescribed in subsection GC32.1of General Conditions "C" is extended to 24 months.
- .2 Manufacturers shall warrant work of this Section against defects and deficiencies in the product material for a period of 24 months. Promptly correct any defects or deficiencies, which become apparent within warranty period at no expense.

- .3 Fire and smoke stop system Contractor hereby warrants workmanship on material installation for period of 24 months. Promptly correct any defects or deficiencies, which become apparent within warranty period at no expense to Owner.

### 1.13 OPERATION AND MAINTENANCE MATERIALS

- .1 Submit O and M products and records in accordance with Section 01 78 00 - Close Out Submittals.
- .2 Incorporate the following materials in the Operation and Maintenance Manual:
  - .1 Material Safety Data Sheets (MSDS).
  - .2 Product literature of each product used on this project.
  - .3 Approved Design Listings and Engineer Judgements.
  - .4 Matrix schedule indicating all Design Listings and EJs and matching them to the penetration or joint type. Included in this schedule shall be a quantity of each Design Listing/EJ on each floor.
  - .5 Daily Worksheets.
  - .6 Certification:
    - .1 Manufacturers Certification cards of each installer that performs installation on the project.
    - .2 Written certification of FCIA Association.
    - .3 Written letters from the Manufacturers accepting installing during:
      - .1 Mock-ups.
      - .2 Substantial performance.
  - .7 Warranty:
    - .1 Manufacturers warranty.
    - .2 Fire Stop Sub-Trade warranty.
  - .8 Life expectancy of each product installed on this project. List date of installation for each product and when the month / year of the expected expiration of each product.
  - .9 Firestopping schedules when applicable with the incorporation of all assembly identification penetration plate numbers and all Design Listings indicated. Submit Hard copies and electronic format on a CD.

## Part 2 Products

### 2.01 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with ULC-S115 or ASTM E814.
  - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against the passage of flame, smoke, water and toxic gases in compliance with requirements of ULC-S115 or ASTM E814, and not to exceed opening sizes for which they are intended, in accordance with ULC or UL Design Numbers or other Design System Listings acceptable to local Authority Having Jurisdiction.
  - .2 Firestopping materials/systems shall be flexible to allow for movement of building structure (refer to architectural and structural) and penetrating items without affecting the adhesion or integrity of the system.
  - .3 Firestop system rating: to match fire resistance rating of wall and floor assembly as indicated in the drawings.

- .2 Fire-stop Methods: Methods used can be as per manufacturer's instructions, provided that their system employed meets or exceeds the requirements of ULC-S115 or ASTM E814.
- .3 Mechanical or Electrical service: penetration assemblies; certified in accordance with ULC-S115 or ASTM E814 and listed in the ULC Guide No. 40 U19.
- .4 Service penetration fire stop components: certified in accordance with ULC-S115 or ASTM E814 and listed in the ULC Guide No. 40 U19.
- .5 Fire resistance rating of installed firestopping assembly not less than fire resistance rating of surrounding floor or wall assembly in accordance with the NBC.
- .6 Firestopping and smoke seals at openings intended for re-entry such as cables; elastomeric seal or non shrink foam cement mortar. Do not use cementitious or rigid seal at such locations.
- .7 Firestopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal. Do not use a cementitious or rigid seal at such locations.
- .8 Fire stopping and smoke seals behind and around mechanical and electrical boxes within wall, floor and ceiling assemblies: elastomeric seal. Do not use a cementitious or rigid seal at such locations.
- .9 Primers: to manufacturer's recommendation for specific material, substrate, and end-use.
- .10 Water: potable, clean and free from injurious amounts of deleterious substrates.
- .11 Damming and back up materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .12 Firestop insulation: pre-formed, semi-rigid, non-combustible mineral wool. Pre-cut into 1220 mm lengths to required depth and width.
- .13 Junction box/outlet sealing putty: intumescent putty, preformed in pads.
- .14 Gypsum Board: as specified in Section 09 21 16 - Gypsum Board Assemblies.
- .15 Sealants: Provide sealants in high visibility, easily identified, safety colours.
  - .1 Vertical joints: non-sagging and having a flame-spread of not more than 25 and a maximum smoke development classification of 100 for walls and 50 for ceilings.
  - .2 Horizontal joints: primerless, single component, self-levelling.
- .16 Acoustic fire rated plug: soft, resilient polyurethane foam plugs. Plugs prefabricated in sizes to fit 51 or 102 mm diameter openings, conduits or sleeves. Intumescent plugs to expand when exposed to heat to quickly close off around combustible products penetrating the opening. Re-installable to allow retrofitting of new items penetrating the opening or conduit. Resilient foam conforms to conduit surfaces. Paintable.
  - .1 Color: red.
  - .2 Rating: up to a 2 hour rating when tested to ASTM E814 and UL 1479.
  - .3 Nominal Density: 304 kg/m<sup>3</sup>.
  - .4 Weight: 50 mm diameter: 91 g. 100 mm diameter: 227 g.
  - .5 Expansion begins: 176° C.
  - .6 Volume expansion: 10 X.
  - .7 In-service temperature: less than 54° C.
  - .8 Shelf Life: N.A.
  - .9 VOC Content: N.A.

- .17 Fire Separation (Barrier) Markings: identify all vertical fire separations within ceiling spaces by a painted red, 75 mm high stencil along upper wall. Marking to be painted 600 mm below horizontal fire separation or roof structure unless otherwise indicated. Final location to be determined on-site. Refer to drawings for locations of fire separations and rating required. Indicate each rating every 6000 mm O.C. with 75 mm high red painted lines in between.
- .18 Schedule of Fire Separations:
  - .1 0 0 hour fire separation.
  - .2  $\frac{3}{4}$   $\frac{3}{4}$  hour fire separation.
  - .3 1.0 1 hour fire separation.
  - .4 2.0 2 hour fire separation.
- .19 Identification Penetration Plate: pre-printed plastic labels. Self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
  - .1 The words: "Warning - Through-Penetration Firestop System. Do Not Disturb. Notify Building Management of Any Damage."
  - .2 Contractor's name, address, and phone number.
  - .3 Project Name.
  - .4 Through-penetration Firestop system designation including name of applicable testing and inspecting agency.
  - .5 Date of installation.
  - .6 Firestop system manufacturer's name.
  - .7 Installer's name.

## 2.02 PRODUCT SYSTEMS

- .1 Provide all products from a single manufacturer for each type of penetration and construction condition.
- .2 Materials of different manufacturers will not be permitted without written authorization from Consultant.
- .3 Acceptable Manufacturers.
  - .1 AD Fire Protection Systems Inc.
  - .2 Hilti Fire Stop Systems.
  - .3 3M Fire Protection Products.
  - .4 Tremco, Tremstop, Firestop Systems.
  - .5 Rectorseal, Biofireshield or Metacaulk.

## Part 3 Execution

### 3.01 MANUFACTURER'S INSTRUCTIONS

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

### 3.02 EXAMINATION

- .1 Verify substrate conditions, previously installed are acceptable for product installation in accordance with manufacturer's instructions and approved design system listings for each condition.
- .2 Ensure that opening / annular space does not exceed the maximum and minimum size or dimensions that is indicated on the approved Design Listing.
- .3 Verify that all joints, service penetrating elements and supporting devices/hangers have been properly installed as indicated on Approved Design Listings. All temporary lines and markings have been removed to meet the approved Design System Listings for each condition has been identified.
- .4 Verify that the proposed Firestopping system is composed of components that are compatible with each other, the substrates forming the openings, and the items, if any, penetrating the firestopping under conditions of application and service, as demonstrated by firestopping manufacturer based on testing and field experience.
- .5 Ensure no additional items have been installed through opening that does not appear on the approved Design Listing.
- .6 Ensure areas that are to be firestopped are accessible for proper application and conditions are suitable for installation of a Firestop system. All areas must also be accessible for inspection.
- .7 Report in writing to the Consultant any defective surfaces or conditions affecting the Firestop system installation, immediately and prior to commencing any installations.
- .8 Proceed only when defected surfaces or conditions have been corrected.
- .9 Ensure temperature within the areas of installation meets or exceeds the minimum temperature range for the products that will be installed in those areas, as based on the manufacturer's recommendations for a minimum two days prior and three days after installation.
- .10 Beginning of installation means acceptance of site conditions.

### 3.03 PREPARATION

- .1 Protect adjacent work areas and finish surfaces from damage during product installation.
- .2 Provide drop sheets or other satisfactory coverings for protection of adjacent areas in accordance with safe and good work practices.
- .3 In areas to be fire stopped ensure that sub state and service penetrations are clean, dry and frost free.
- .4 Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work. Remove tape as soon as it is possible to do so without disturbing the firestopping seal with substrates.
- .5 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
- .6 Prepare surfaces in contact with firestopping materials and smoke-seals to manufacturer's instructions.
- .7 Maintain insulation around pipes and ducts penetrating fire separation. Confirm that fire stop system has been tested with actual pipe or duct insulation penetrating fire separation that is indicated in the approved ULC or UL Design System Listing.

- .8 Surfaces to which Firestop materials are to be installed, shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
- .9 Ensure that multi-penetration openings have been framed and boarded out, all around the annular opening as indicated in the Firestopping Detail Drawings prior to prepping the opening.
- .10 Confirm that the temperature and humidity conditions during and after installation are being maintained as per manufacturers' recommendations.

### 3.04 INSTALLATION

- .1 Install firestopping and smoke-seal material and components in accordance with manufacturer's instructions and rated system as tested to ULC-S115, and ULC or UL Design System Listings.
- .2 Coordinate with other Sub-Trades to assure that all pipes, conduit, cable, and other items, which penetrate fire separations have been permanently installed prior to installation of Firestop systems.
- .3 Schedule the work to assure that fire separations and all other construction that conceals penetrations are not erected prior to the installation of fire and smoke stop systems.
- .4 Seal holes or voids made by through-penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure that both continuity and integrity of fire-separation are maintained.
- .5 Provide temporary forming as required. Remove forming material only after Firestop system has gained sufficient strength and after initial curing as per manufacturer's instructions.
- .6 Tool or trowel exposed surface to a neat finish. Remove excess compound promptly as work progresses and upon completion.
- .7 Refer to Firestopping Drawing Details, Mechanical and Electrical Sections and drawings for further information.
- .8 Seal all voids between new fire rated wall assemblies and new or existing building walls to form a draft-tight barrier and act to retard the passage of flame, toxic gases and smoke.
- .9 Install Firestop material to obtain fire resistance rating not less than the fire resistance rating of surrounding floor and wall assembly.
- .10 Seal around electrical boxes and outlets with sealing putty in accordance with manufacturer's instructions.
- .11 Install acoustic fire rated plug in accordance with Manufacturer's written instructions. Remove sharp edges or protruding wires or ties that can damage plugs. For blank openings, insert plug into end of sleeve or opening on both sides of wall. When cables are present, slit plug to accommodate single or grouped cables. Fill spaces between grouped cables.

### 3.05 SCHEDULE

- .1 Fire stop and smoke-seal includes but not limited, to the following locations:
  - .1 Provide appropriate Firestop System when exposed to view, architectural finish, traffic, moisture, heat, movement and physical damage.
  - .2 Penetrations through fire-resistance-rated new or existing masonry, concrete, and gypsum board partitions/walls, floors and roof assemblies.
  - .3 Intersection of fire-resistance-rated new or existing masonry, concrete and gypsum board partitions.



- .4 Joints at top and bottom of fire resistance rated new or existing concrete masonry and gypsum board partitions. Joints to allow for independent movement.
- .5 Control and sway joints in fire-resistance-rated new or existing masonry and gypsum board partitions and walls.
- .6 Penetrations through fire-resistance-rated floor slabs/systems, ceilings and roof.
- .7 Openings and sleeves installed for future use through fire separations and unused openings and sleeves constructed as part of work.
- .8 Around mechanical and electrical assemblies/devices penetrating fire separations.
- .9 Between edge of fire-resistant floor or roof assemblies and exterior wall assemblies.
- .10 Between floors, walls, ceilings and roof assemblies at horizontal and vertical fire resistant ratings at floor expansion joints.
- .11 Rigid ducts: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
- .12 Mechanical and electrical recessed boxes in walls and partitions.
- .13 Where indicated on working drawings and specification detail drawings.

### 3.06 SEQUENCE OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Consultant.
- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified fire stop system component. Ensure pipe insulation installation precedes fire stopping.

### 3.07 INSTALLING FIRESTOP JOINT SYSTEMS

- .1 Install joint fillers to provide support of Firestop materials during application and at the position required to provide the cross-sectional shapes and depths of installed Firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- .2 Install systems by proven techniques that result in Firestop materials as recommended by the manufacturer:
  - .1 Directly containing and fully wetting joint substrates.
  - .2 Completely filling recesses provided for each joint configuration.
  - .3 Providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.
  - .4 Tool non-sag Firestop materials immediately after their application and prior to the time skinning begins. Form smooth, uniform beads of configuration indicated or required to:
    - .1 Produce fire-resistance rating.
    - .2 To eliminate air pockets.
    - .3 To ensure contact and adhesion with sides of joint.

### 3.08 INSTALLATION OF ASSEMBLY IDENTIFICATION PENETRATION PLATE.

- .1 Install [Identification plates](#) adjacent to all through wall/floor service penetrations firestopped and at joint penetrations. Provide one assembly identification plate per penetration opening and one assembly identification plate at every 6000 mm along wall/floor joints.

- ~~4.2~~ Attach labels permanently to surfaces of penetrated construction on both sides of assembly. Apply labels adjacent to and within 150 mm of the edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems.
- ~~2.3~~ Penetration plate shall be completely filled out and installed prior to requesting substantial performance.
- ~~3.4~~ Clean substrate prior to applying penetration plate.
- ~~4.5~~ Securely apply penetration plate to substrate, by providing adequate adhesive.

### 3.09 REPAIRS AND MODIFICATIONS

- .1 Identify damaged or re-entered seals requiring repair or modification.
- .2 Remove loose or damaged materials. If penetrating items are to be added, remove sufficient material to insert new elements. Cause no damage to the balance of the seal.
- .3 Ensure that surfaces to be sealed are clean and dry. Install materials in accordance with specified installation requirements herein. Use only materials approved by manufacturer as suitable for repair of original seal. Do not mix different manufacturer's products.

### 3.10 FIELD QUALITY CONTROL

- .1 Inspections: notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
- .3 Engage Manufacturer's Representative to perform periodic observations of firestopping systems:
  - .1 Examine Firestop penetration seals for proper installation, labelling, adhesion and curing as may be appropriate for the respective seal material.
  - .2 Keep areas of work accessible and notify Consultant, code authorities and/or designated inspectors of work.
  - .3 Document completion and observation as required.

### 3.11 REVIEW

- .1 Consultant will perform random observation reviews during the course of construction and prior to closing off any concealed areas. These observations shall be based on ASTM E2174 Standard Practice for on-site inspection of Installed Firestop Systems and ASTM E2393 Standard practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers. Notify Consultant minimum of 48 hours prior to requesting review.
- .2 Upon completion of construction and prior to requesting Substantial Performance Review, Firestopping Contractor and Manufacturer's Representative shall inspect all firestopping work, prepare a deficiency list, submit this list to the Consultant and then the Firestop Contractor shall repair any deficiencies and re-inspect work to ensure that all deficiencies have been completed.
- .3 Firestop Contractor shall request Substantial Performance review of work once all work is completed, inspected and identified with assembly identification penetration plates.
- .4 During Substantial Performance Review, the Firestop Contractor shall be present along with the Manufacturer's representative and the Consultant.

- .5 Perform exploratory review (destructive test) based on ASTM E2174, and E2393. Cut out the Firestopping as directed by the Consultant and remove to ensure the Firestop system installed meets or exceeds the Design System Listing as identified.
- .6 The Firestopping Contractor shall do all cutting and removal of the systems for visual review from the Consultant and Manufacturer's Representative. Once the review is completed and accepted, the Firestopping Contractor shall replace the Firestop system with new.
- .7 Include for a minimum of 2% of each Design Listing for each area of 900m2 based on ASTM E2174 for such exploratory reviews per approved Design System Listings. Perimeter Joints shall have a minimum cut test every 15 meters based on ASTM E2393. Bottom and top of wall joints, wall to wall joints and building expansion joints shall have a minimum cut test every 15 meters.

### 3.12 CLEANING

- .1 Remove equipment, excess materials and debris and clean adjacent surfaces immediately after application. Use methods and cleaning materials approved by Manufacturer.
- .2 Protect firestopping during and after curing period from contact with contaminating substances. Repair all damage.
- .3 Remove temporary dams after initial set of fire stop and smoke seal materials.

### 3.13 SCHEDULES

- .1 Produce a schedule for all openings in Wall Assemblies using the following sample:

| Ref No | Dwg No | Room No. | Wall Type | I.D Plate No | Photo No. | Quantity | Description | Size | FS No. | Design No. | Penetration Notes |
|--------|--------|----------|-----------|--------------|-----------|----------|-------------|------|--------|------------|-------------------|
|        |        |          |           |              |           |          |             |      |        |            |                   |
|        |        |          |           |              |           |          |             |      |        |            |                   |

- .2 Produce a schedule for all openings in Ceiling Assemblies using the following sample:

| Ref No | Dwg No | Room No. | Ceiling Type | I.D Plate No | Photo No. | Quantity | Description | Size | FS No. | Design No. | Penetration Notes |
|--------|--------|----------|--------------|--------------|-----------|----------|-------------|------|--------|------------|-------------------|
|        |        |          |              |              |           |          |             |      |        |            |                   |
|        |        |          |              |              |           |          |             |      |        |            |                   |

- .3 Produce a schedule for all openings in Floor Assemblies using the following sample:

| Ref<br>No | Dwg<br>No | Room<br>No. | Floor<br>Type | I.D<br>Plate<br>No | Photo<br>No. | Quantity | Description | Size | FS<br>No. | Design<br>No. | Penetration<br>Notes |
|-----------|-----------|-------------|---------------|--------------------|--------------|----------|-------------|------|-----------|---------------|----------------------|
|           |           |             |               |                    |              |          |             |      |           |               |                      |
|           |           |             |               |                    |              |          |             |      |           |               |                      |

END OF SECTION

**PART 1 General**

**1.01 SECTION INCLUDES**

- .1 Seismic Transition strip. Preformed, pre-compressed, self-expanding, compression type joint seal system. Seals provided with factory applied, coloured, UV stabilized, silicone sealant on exposed faces. Watertight, energy efficient, interior, above grade, wall application.
- .2 Seal to accommodate seismic movements. Seal is anchored by the back pressure inherent in the elastic foam core.

**1.02 RELATED SECTIONS**

- .1 Section 07 95 13 - Expansion Joint Cover Assemblies.
- .2 Section 07 92 10 - Joint Sealants.

**1.03 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM C661-15. Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
  - .2 ASTM E283-04(2012). Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - .3 ASTM E330/E330M-14. Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .4 ASTM E331-00(2016). Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

**1.04 DESIGN REQUIREMENTS**

- .1 Design seals to exceed ASTM E330 (procedure A) and ASTM E331 with no deflection at both positive and negative pressures up to 4954 Pascals.
- .2 Design seal to accommodate temperature range from minus 40 degrees C to plus 85 degrees C.
- .3 Joint movement: design to permit unrestricted lateral, vertical or omnidirectional movement of up to +/-50% (total 100%) of joint width. Nominal joint width: 50 mm. Design seal to accommodate simultaneous movement in vertical and horizontal directions.
- .4 Design seals to meet the following:
  - .1 Capable of withstanding 65 degrees C for 3 hours while compressed down to the minimum of movement capability dimension of the basis of design product (-50% of nominal material size) without evidence of any bleeding of impregnation medium from the material.
  - .2 The same material after the heat stability test and after being cooled to room temperature will subsequently self-expand to the maximum of movement capability dimension of the basis-of-design product (+50% of nominal material size) within 24 hours at room temperature 20 degrees C.

- .5 Design seals to have a maximum air permeability of 0.0078 liters per second per square meter at 75 Pascals in accordance with ASTM E283.
- .6 Provide certified Test reports from independent Testing Laboratories confirming that the products exceed the specified performance requirements.

#### **1.05 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Product Data Sheets for each type of seal. Include manufacturer's specifications and standard Product Data Sheets. Provide profiles, dimensions, anchorage details, available colours and accessories. Indicate lengths, accessories. Indicate locations. Indicate details for butt joints and splices. Indicate mitres, layout of the work, affected adjacent construction.
- .3 Provide Installation Instructions. Indicate Manufacturer's special installation requirements, including rough-in sizes. Indicate required tolerances for item placement.
- .4 Provide samples. Submit duplicate 300 mm long sample pieces of seals in each colour selected.
- .5 Submit typical expansion joint drawings indicating pertinent dimensions, general construction, expansion joint opening dimensions and product information.
- .6 Provide product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver products to site in Manufacturer's original, intact, labeled containers. Handle and protect as necessary to prevent damage or deterioration during shipment, handling and storage. Store in accordance with manufacturer's installation instructions.
- .3 Waste Management and Disposal. Separate and recycle waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. Remove from site and dispose of packaging materials at appropriate recycling facilities.

#### **1.07 AMBIENT CONDITIONS**

- .1 Maintain air temperature and structural base temperature at installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

### **PART 2 Products**

#### **2.01 MATERIALS**

- .1 Core: self expanding, open cell polyurethane foam impregnated with a water based, non-drying, 100 % acrylic dispersion. Core to be free from any waxes or wax compounds.
- .2 Sealant: factory applied to foam core. U/V stabilized, factory cured, low-modulus silicone. Integral coloured. Colour: grey, selected by Consultant from full range of available colours. Apply sealant to the foam while it is partially compressed to a width greater than maximum joint extension and cured before final compression. When the seal is compressed to final dimension, the sealant will create a bellows to accommodate joint movement. Hardness: Shore A durometer hardness 25 plus or minus 5 units to ASTM C661.

- .3 Sealant: exposed joints in accordance with Section 07 92 10 - Joint Sealants.

## **2.02 FABRICATION**

- .1 Fabricate in maximum practical lengths to minimize splices and joints. Provide seal pre-compressed to slightly less than the nominal joint size. Package in shrink wrapped with mounting adhesive applied to one face.
- .2 Provide factory manufactured universal 90 degree corner units. Minimum 300 mm long and 150 mm long alternate leg lengths. Provide corner units at each directional change and terminations into horizontal plane surfaces.

## **PART 3 Execution**

### **3.01 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Verify existing conditions before starting work. Verify that field measurements are correct and are within the tolerances as permitted by the manufacturer. Verify that joint preparation and affected dimensions are acceptable. Ensure sound and clean substrates before commencing installation.

### **3.02 INSTALLATION**

- .1 Install seals in accordance with Manufacturer's written instructions. Provide properly formed and prepared joint openings constructed to the dimensions indicated.
- .2 Clean the joint opening of all contaminants immediately prior to installation of seal. Repair spalled, irregular or unsound surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Ensure that there is sufficient depth to receive the full depth of the seal plus a minimum of 12 mm for the application of corner beads.
- .3 Set work plumb, square, level, free from distortion. Align work plumb and level and flush with adjacent surfaces.
- .4 Seal butt joints to manufacturer's instructions to provide watertight and light tight joints using sealant.
- .5 No drilling, or screwing, or fasteners of any type are permitted to anchor the sealant system into the substrate.
- .6 Apply continuous corner bead of sealant at edges of seal to provide airtight connection between seal and edges of joint.
- .7 Protect the system and its components during construction.

### **3.03 CLEANING**

- .1 Clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .3 Remove traces of primer, caulking, sealants and filler materials.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .2 Section 08 11 00 - Metal Doors and Frames.
- .3 Section 08 44 13 - Glazed Aluminum Curtain Walls.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C834-14. Standard Specification for Latex Sealants.
  - .2 ASTM C919-12. Standard Practice for Use of Sealants in Acoustical Applications.
  - .3 ASTM C920-14a. Standard Specification for Elastomeric Joint Sealants.
  - .4 ASTM C1184-14, Standard Specification for Structural Silicone Sealants.

**1.03 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's product data, printed product literature and data sheets. Include product characteristics, performance criteria, available colours and limitations. Include information on each type of compound, conformance with specified standard, primer, and compatibility with adjacent materials.
- .3 Submit 2 copies of WHMIS MSDS.
- .4 Submit duplicate samples of each type of material and colour. Submit cured samples of exposed sealants for each colour where required to match adjacent material.
- .5 Submit complete manufacturer's installation instructions for each product. Indicate special handling criteria, surface preparation procedures, application sequence and cleaning procedures.
- .6 Provide Sustainable Design Submittals LEED in accordance with Section 01 35 21 - LEED Requirements.
  - .1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.
  - .2 Submit calculations on end of project recycling rates, salvage rates, and landfill rates demonstrating that the specified percentage of construction wastes were recycled or salvaged.

**1.04 QUALITY ASSURANCE/MOCK-UP**

- .1 Construct Mock-Up in accordance with Section 01 45 00 - Quality Control.
- .2 Locate where directed by Consultant. Construct Mock-Up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant.
- .3 Mock-Up will be used to judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Allow 24 hours for inspection of Mock-Up by Consultant before proceeding with sealant work.
- .5 When accepted, Mock-Up will demonstrate minimum standard of quality required for this Work. Approved Mock-Up may not remain as part of finished Work.



- .6 Remove mock-up and dispose of materials when no longer required and when directed by Consultant.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.
- .3 Store materials off ground, indoors, in dry location in clean, dry, well ventilated area. Store and protect joint sealants from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

#### **1.06 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction / Demolition Waste Management.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers. Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .5 Handle and dispose of hazardous materials in accordance with appropriate Federal, Provincial and Municipal regulations.
- .6 Fold up metal banding, flatten, and place in designated area for recycling.

#### **1.07 PROJECT CONDITIONS**

- .1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use. Proceed with installation of joint sealants only when the following conditions are met:
  - .1 When ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
  - .2 When joint substrates are dry.
- .2 Proceed with installation of joint sealants only where joint widths are within range allowed by joint sealant manufacturer for applications indicated.
- .3 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

#### **1.08 ENVIRONMENTAL REQUIREMENTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System regarding use, handling, storage, and disposal of hazardous materials.
- .2 Arrange for ventilation system to be operated on maximum outdoor air and exhaust during installation of caulking and sealants. Ventilate area of work as directed by Consultant by use of approved portable supply and exhaust fans.

**Part 2 Products**

**2.01 SEALANT MATERIALS**

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.
- .3 Where sealants are qualified with primers use only these primers.

**2.02 SEALANT MATERIAL DESIGNATIONS**

- .1 Sealant TYPE A: one component, medium modulus, neutral cure silicone. To ASTM C920, Type S, Grade NS, Class 50. Use: NT, M, G, and A. Un-primed adhesion to most substrates. Shore A hardness: 30. Excellent U/V resistance. Available in a minimum of 7 colours.
- .2 Sealant TYPE B: Structural Silicone Glazing adhesive. One component, high modulus, shelf stable, neutral cure formulated for structural silicone glazing applications. To ASTM C1184: Type S. Use: G. To ASTM C920: Type S, Grade NS, Class 50. Use NT, G, and A. Ultimate Tensile to ASTM C1135: 170 psi. Ultimate Tensile to ASTM D412: 350 psi. Shore A durometer hardness: 40.
- .3 Sealant TYPE E: one component, solvent release, acrylic latex. To ASTM C834. Type OP or Type C. Use Grade 18 C or Grade 0 C or Grade NF as required by application criteria.
- .4 Sealant TYPE F: one component, acetoxysilicone containing non toxic fungicidal agents. To ASTM C920, Type S, Grade NS, Class 25. Use: NT, G, A and O.
- .5 Sealant TYPE H: to ASTM C919. one component, non skinning, non hardening, butyl rubber acoustic.
- .6 Backer rods: oversized 30 - 50 %. Shore A hardness of 20. Tensile strength of 830 - 900 KPa.
  - .1 Vertical surfaces: extruded polyolefin rod.
  - .2 Horizontal surfaces: extruded closed cell polyurethane foam. Standard Backer Rod.
  - .3 High density foam: extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20. Tensile strength 140 to 200 kPa. Extruded polyolefin foam, 32 kg per cubic metre density, or neoprene foam backer, size as recommended by manufacturer.
- .7 Bond breaker: pressure sensitive polyethylene plastic tape. Formulated so that sealant will not bond. For installation where minimum joint depth cannot be obtained.

**2.03 SEALANT SELECTION**

- .1 Exterior Joints:
  - .1 Perimeters of openings where frames meet exterior facade of building (i.e. concrete, masonry): Sealant TYPE A.
  - .2 Expansion and control joints in poured-in-place concrete walls: Sealant TYPE A.
  - .3 Control and expansion joints in walls: Sealant TYPE A.
  - .4 Coping joints and coping-to facade joints: Sealant TYPE A.
  - .5 Joints in horizontal wearing surfaces: Sealant TYPE A.
  - .6 Structural silicone glazed curtain wall assembly: Sealant TYPE B.
- .2 Interior Joints:

- .1 Perimeter of exterior openings as detailed on drawings: Sealant TYPE A.
- .2 Control and expansion joints in poured-in place concrete walls: Sealant TYPE A.
- .3 Control and expansion joints in masonry walls: Sealant TYPE A.
- .4 Interior control and expansion joints in floors: Sealant TYPE A.
- .5 Perimeters of interior frames, as detailed and itemized: Sealant TYPE E.
- .6 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant TYPE A.
- .7 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, water closets, basins, vanities): Sealant TYPE F.
- .8 Exposed control joints in drywall: Sealant TYPE E.
- .3 Acoustic Joints, Acoustical separations, Acoustical assemblies.
  - .1 Openings and penetrations in acoustical Walls, Ceilings and Floor assemblies: Sealant TYPE H.
  - .2 Perimeter of Acoustical Separations: Sealant TYPE H.
  - .3 Acoustical details as indicated: Sealant TYPE H.

## **2.04 CLEANERS AND PRIMERS**

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

## **Part 3 Execution**

### **3.01 VERIFICATION**

- .1 Verify that conditions of substrate are acceptable for joint sealants installation in accordance with manufacturer's written instructions.
- .2 Visually inspect substrate in presence of Consultant. Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.02 PROTECTION**

- .1 Protect installed Work of other trades from staining or contamination.

### **3.03 SURFACE PREPARATION**

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Ensure flashings are well wedged and solid.
- .3 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease and other matter which may impair Work.
- .4 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .5 Ensure joint surfaces are dry and frost free.
- .6 Prepare surfaces in accordance with manufacturer's directions.

**3.04 PRIMING**

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

**3.05 BACKUP MATERIAL**

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

**3.06 MIXING**

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

**3.07 APPLICATION**

- .1 Sealant.
  - .1 Apply sealant in accordance with manufacturer's written instructions.
  - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
  - .3 Apply sealant in continuous beads.
  - .4 Apply sealant using gun with proper size nozzle.
  - .5 Use sufficient pressure to fill voids and joints solid.
  - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
  - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing.
  - .1 Cure sealants in accordance with sealant manufacturer's instructions.
  - .2 Do not cover up sealants until proper curing has taken place.

**3.08 CLEANING**

- .1 Conduct regular daily cleaning in accordance with Section 01 74 11 - Cleaning. Leave Work area clean at end of each day.
- .2 Clean adjacent surfaces immediately. Remove excess and droppings, using recommended cleaners as work progresses. Remove masking tape after initial set of sealant.
- .3 Upon completion remove surplus materials, rubbish, tools and equipment.

**3.09 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

**END OF SECTION**

**Part 1 General**

**1.01 SECTION INCLUDES**

- .1 Horizontal expansion joint assemblies for floor to floor conditions.

**1.02 RELATED SECTIONS**

- .1 Section 07 84 00 - Firestopping.
- .2 Section 07 91 13 - Compression Seals.
- .3 Section 07 92 00 - Joint Sealing.

**1.03 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM B209-14. Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - .2 ASTM B221-12a. Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .2 Canadian Standards Association International (CSA).
  - .1 CSA B651-12. Accessible Design for the Built Environment.

**1.04 DESIGN REQUIREMENTS**

- .1 Joint movement: design to permit unrestricted lateral, movement of up to +/- 50 % of joint width.
- .2 Provide expansion control system incorporating multiple elastomeric seals each exhibiting a minimum movement capability of 9.53 mm (3/8 inch). Accommodate variable design movements by incorporating additional seals as required mechanically locked and supported by aluminum extruded profiles. Provide non-slip flat walking surface flush with adjacent floor finishes by alternating the seals and aluminum profiles in a modular pattern supported by pre engineered bars of selected size, shape and spacing. Maintain equidistant spacing between all aluminum profiles throughout the full range of movement.
- .3 Provide expansion control system that is capable of accommodating movement without stress to its components. Provide integrated system consisting of an aluminum base member and integral elastomeric seals designed to accommodate various project conditions and finish floor treatments. Anchor preassembled joint to floor slab utilizing aluminum edge profiles and manufacturer's standard anchors.
- .4 Provide floor joints meeting the barrier free requirements of CSA B651.

**1.05 SUBMITTALS DATA**

- .1 Provide Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit Product Data Sheets for each type of joint. Include manufacturer's specifications and standard product data sheets. Provide joint assembly profiles, profile dimensions, anchorage devices, available colours and finishes and accessories.
- .3 Submit shop drawings for each type of joint. Indicate lengths, fasteners, accessories, anchors and seals. Indicate locations for each unit. Indicate finishes and profiles required for each condition. Indicate details for butt joints and splices. Indicate mitres, layout of the work,

affected adjacent construction. Indicate details for built in seals and for site applied sealants. Submit details for anchors. Submit template drawings. Submit typical cross section indicating pertinent dimensioning, general construction, component connections.

- .4 Provide Installation Instructions. Indicate Manufacturer's special installation requirements, including rough-in sizes. Provide templates for cast-in or placed frames or anchors. Indicate required tolerances for item placement.
- .5 Submit duplicate, 150 mm long samples of each type of joint assembly. Sample to illustrate profile, dimension, colour, and finish.
- .6 Provide product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### **1.06 DELIVERY STORAGE AND HANDLING**

- .1 Deliver products in manufacturer's original, labeled containers and store under cover in a dry location until installed. Store off the ground, protect from weather and construction activities.

#### **1.07 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

### **Part 2 Products**

#### **2.01 MATERIALS**

- .1 Aluminum extrusions: to ASTM B221, Alloy 6061-T6 or 6063-T5. Finish: standard mill finish.
- .2 Aluminum shapes: to ASTM B209, Alloy 5005-H34. Finish: standard mill finish.
- .3 Elastomeric seal: factory bonded, reinforced, elastomer. To manufacturer's design standard to suit joint conditions. Co-extruded seal profile utilizing Santoprene material. Shore A hardness of 64 +/- 5 between the seal lugs. Mechanically interlock the seal into corresponding aluminum profiles using no adhesives for permanent installation. Individual seal profiles shall provide 9.53 mm total movement. Colour selected by Consultant from manufacturer's full and extended range of available colours.
- .4 Moisture Barrier: reinforced, tear resistant, sheet vinyl. Minimum thickness: 0.066. Continuous, flexible seal to provide watertight juncture along base of joint covers. Provide in maximum practical continuous length.
- .5 Anchors: minimum 9.53 mm diameter x 75 mm long concrete expansion anchor at maximum 450 mm OC to secure aluminum base member to floor slab. Zinc plated "Hilti" concrete expansion anchor with nut and washer.
- .6 Accessories:
  - .1 Butt joint seal: to provide watertight and light tight seal between lengths of joint assembly.
  - .2 Concealed fasteners and anchors: galvanized steel, stainless steel or extruded aluminum.
  - .3 Blockout repair: single component rapid strength repair mortar.

- .4 Blockout infill / levelling bed: non-catalyzed, non-shrink grout containing mineral aggregate. Minimum 6.0 mm thick levelling bed.
- .7 Firestopping: as specified in Section 07 84 00 - Firestopping.

## **2.02 FABRICATION**

- .1 Fabricate expansion joints, square, true, straight and accurate to required sizes and profiles.
- .2 Fabricate in maximum practical lengths to minimize splices and joints. Factory fabricate terminations and transitions with ends prepared for field splicing utilizing manufacturer's standard clips.
- .3 Provide system fully assembled and preset in the factory prior to shipment. Shop assemble components and package with anchors, levelling nuts, inserts and fittings as required for a complete installation to suit installation and project requirements.
- .4 Provide acceptable means of anchorage, such as anchor clips, expansion bolts and shields, welded studs or toggles.
- .5 Miter cut in the field to conform to directional changes

## **Part 3 Execution**

### **3.01 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Verify existing conditions before starting work. Verify that field measurements are correct and are within the tolerances as permitted by the manufacturer. Verify that joint preparation and affected dimensions are acceptable.
- .3 Ensure sound and clean substrates before commencing installation.

### **3.02 PREPARATION**

- .1 Provide anchoring devices for installation and embedding.
- .2 Provide templates and rough-in measurements.

### **3.03 INSTALLATION**

- .1 Install utilizing manufacturer's blockout repair and infill materials.
- .2 Set expansion joint systems to the proper width for the ambient temperature at the time of installation.
- .3 Set work plumb, square, level, free from distortion. Align work plumb and level and flush with adjacent surfaces.
- .4 Secure work accurately to structure in manner not restricting joint movement. Rigidly anchor to substrate to prevent misalignment.
- .5 Maintain continuity of moisture barrier.
- .6 Seal butt joints to manufacturer's instructions to provide watertight and light tight joints using sealant.
- .7 Firestopping: as specified in Section 07 84 00 - Firestopping.
- .8 Sealant: exposed joints in accordance with Section 07 92 00 - Joint Sealing.

**3.04 PROTECTION OF FINISHED WORK**

- .1 Protect installed work in accordance with Manufacturer's written instructions.
- .2 Do not permit traffic over unprotected floor joint surfaces.
- .3 Protect cover plates during construction. Provide removable strippable coating or reinforced cloth tape to protect finish surfaces. Remove shop protection prior to final inspection.

**3.05 CLEAN-UP**

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .2 Clean all exposed metal and elastomeric surfaces with a suitable cleaner that will not harm or attack the finish. Inspect for any damage that may have resulted from other work or building trades.
- .3 Remove traces of primer, caulking, epoxy and filler materials; clean expansion joint covers.

**3.06 SCHEDULE**

- .1 Floor to Floor: Acceptable Materials: Wabo VIP series expansion control system. Model VIP-2250 manufactured by Watson Bowman Acme Corp.
  - .1 Joint opening: 50 mm. Movement: plus 25 mm and minus 25 mm.
  - .2 Floor covering: hard surface. Floor finish to sit flush with top edge of elastomeric seal.

**END OF SECTION**



**Part 1 General**

**1.01 SUMMARY**

- .1 Fire-rated and non rated, pressed steel door and glazed sidelight frames. Tested and certified to meet specified fire ratings.
- .2 Fire-rated and non rated, flush, continuously welded seam, flush steel swinging doors.
- .3 Thermally broken frames.
- .4 Honeycomb core doors. Stiffened steel core doors. Insulated core doors.
- .5 Specialty sand filled doors.

**1.02 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.
- .2 Section 08 71 00 - Door Hardware.
- .3 Section 08 81 00 - Glass Glazing.
- .4 Section 09 91 23 - Painting.

**1.03 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A653/A653M-11. Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM C920-11. Standard Specification for Elastomeric Joint Sealants.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA G40.20-13/G40.21-13. General requirements for rolled or welded structural quality steel / Structural quality steel.
  - .2 CSA W59-03(R2008). Welded Steel Construction (Metal Arc Welding).
- .3 Canadian Steel Door Manufacturers Association (CSDMA).
  - .1 CSDMA Section 08 11 00 - 2006. Recommended Specifications for Commercial Steel Door and Frame Products.
  - .2 CSDMA. Recommended Selection And Usage Guide For Commercial Steel Door And Frame Products. 2009.
  - .3 CSDMA. Recommended Dimensional Standards for Commercial Steel Door and Frames. 2000.
- .4 Hollow Metal Manufacturers Association (HMMA).
  - .1 HMMA 802-07. Manufacturing of Hollow Metal Doors and Frames.
  - .2 HMMA 840-07. Installation and Storage of Hollow Metal Doors and Frames.
  - .3 HMMA 841-07. Tolerances and Clearance for Commercial Hollow Metal Doors and Frames.
- .5 National Fire Protection Association (NFPA).
  - .1 NFPA 80-2013. Standard for Fire Doors and Other Opening Protectives.
  - .2 NFPA 252-2012. Standard Methods of Fire Tests of Door Assemblies.

- .6 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN/ULC-S104-10-EN. Standard Method for Fire Tests of Door Assemblies.
  - .2 CAN/ULC-S105-09-EN. Standard Specification For Fire Door Frames Meeting The Performance Required By CAN/ULC-S104.
  - .3 CAN/ULC-S702-09-AM1-EN. Standard for Mineral Fibre Thermal Insulation for Buildings.
  - .4 CAN/ULC-S704-03. Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

#### 1.04 DESIGN REQUIREMENTS

- .1 Design exterior thermally broken frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- .2 Maximum deflection for exterior steel frames under wind load of 1.2 kPa not to exceed 1/175th of span.
- .3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 and NFPA 252 for ratings specified or indicated. Test doors and frames as a complete assembly to meet specified fire rating.
- .4 Provide fire labelled frames and doors for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN/ULC-S104 or NFPA 252 and list by nationally recognized agency having factory inspection service. Construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .5 Design special sand filled door assembly as a vertically stiffened door to accommodate installation of sand core on site with removable top inspection ports.

#### 1.05 SUBMITTALS

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data. Submit manufacturers standard product literature on doors, frames and accessories.
- .3 Submit shop drawings.
  - .1 Provide elevations of each glazed frame, door and frame. Indicate details of internal reinforcement, anchor types, closure methods, location of cut-outs for hardware. Indicate sizes of all glazed panels.
  - .2 Indicate each type of: door material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware. Indicate details for glazed panels. Indicate factory finishes. Indicate Fire Rating for each door type.
  - .3 Indicate each type frame material, core thickness, reinforcements, location of anchors and exposed fastenings and reinforcing. Indicate finishes. Indicate Fire Rating for each frame type. Indicate details for glazes panels.
  - .4 Indicate details for each type of glazing panel. Thickness, type of glass, details for installation into doors, details and information on glazing compounds and materials. Details for fixed and applied stops.
- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .5 Submit test and engineering data. Submit statement of conformance that the doors, frames and glazed panels comply with specified requirements.

- .1 Submit independent test data from an accredited testing laboratory approved by the Consultant indicating compliance with the specified Fire Rating requirements. Test Report is to be stamped and signed by a registered Professional Engineer licensed to practice in Ontario.
- .2 Test doors are required to be similar to the project doors. Door panel areas and mullion spans for the project doors are required to be within 10% of the test doors.
- .3 Include a summary sheet outlining the following:
  - .1 Description of the test performed.
  - .2 Table of test results by door type/location.
  - .3 Table of comparison between test doors and project doors.
- .6 Submit samples.
  - .1 Submit one 300 x 300 mm corner sample of each door type. Show cutout for glazing. Include details of door core construction.
  - .2 Submit one 300 x 300 mm corner sample of each type of frame. Show cutout for butt hinges.
  - .3 Submit one 300 x 300 mm corner sample of glazed panels. Submit 300 mm long samples of glazing materials. Submit 300 mm length of glass stop.
  - .4 Submit one sample of anchors and clips.
- .7 Submit installation instructions.
- .8 Closeout Submittals: Provide maintenance data for doors, frames and hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### **1.06 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications. Door manufacturer who is regularly engaged in the design, manufacture, fabrication, finishing and installation of custom steel doors and frames of institutional complexity and scope. Manufacturer to provide written documentation to demonstrate to the satisfaction of the Consultant that they have successfully performed on comparable projects for a minimum period of ten years.
- .2 Convene pre-installation meeting 14 days before starting work of this section. Consultant, door manufacturer representative and installation contractor to attend. Meeting to review installation and coordination with other work.

#### **1.07 MOCK-UP**

- .1 Construct Mock-Up in accordance with Section 01 45 00 - Quality Control.
  - .1 Prepare a Mock-Up of door installation where directed by Consultant.
  - .2 Schedule construction of Mock-Up to ensure attendance of Consultant during preparation and installation. Provide minimum of 72 hours written advance notice to Consultant.
  - .3 Ensure blocking, framing and structural supports are in place prior to Mock-Up preparation.
  - .4 Install door and frame as per reviewed shop drawings.
  - .5 Install interior trim and touch-up where required or directed by Consultant.
  - .6 Approved Mock-Up may form part of final Work.

#### **1.08 DELIVERY, STORAGE AND HANDLING**

- .1 Transport, handle, store, and protect products in accordance with Section 01 61 00 - Common Product Requirements and as per manufacturer's written instructions.

- .2 Comply with HMMA 840.
- .3 Weld minimum two temporary jamb spreaders per frame prior to shipment.
- .4 Protect units against damage from the elements, construction activities and other hazards before, during, and after installation.
- .5 Provide temporary protection for exposed surfaces. Individually wrap and crate each unit for transport to site. Brace frames to maintain squareness and rigidity during shipment and installation.
- .6 Handle and store material in such a manner that no damage will be done to the materials or to the work of other Sections.
- .7 Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage. Store in vertical position, spaced with blocking to permit air circulation between components. Store materials out of water and covered to protect from damage.
- .8 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.
- .9 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. Remove from site and dispose of packaging materials at appropriate recycling facilities. Divert unused metal materials from landfill to metal recycling facility. Divert unused wood materials from landfill to recycling facility.

#### 1.09 WARRANTY

- .1 Provide a signed written guarantee, stating that the work of this Section shall remain free of defects in materials and workmanship for a period of five years after substantial performance of the Work. Warrant that work will be water and weather tight, structurally sound and free from distortion and deformation.

### Part 2 Products

#### 2.01 MATERIALS

- .1 Hot dipped galvanized Sheet Steel: Galvanized steel to ASTM A653/A653M. Coating designation Z275 for all door and frame assemblies.
- .2 Unless specified otherwise, provide all components of the minimum base steel thickness in accordance with CSDMA Section 08 11 00, Table 1 - Thickness for Component Parts.
- .3 Reinforcement: structural steel channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM/A653M, ZF75.
- .4 Steel stiffener: vertical steel channel, hat profile. 1.0 mm thick.
- .5 Honeycomb: structural small cell, 24.5 mm maximum kraft paper 'honeycomb'. Weight: 36.3 kg per ream. Minimum density: 16.5 kg per cubic metre. Sanded to required thickness.
- .6 Insulation:
  - .1 Fiberglass batt: to CAN/ULC-S702. Semi rigid type. Density 24 kg per cubic metre.
  - .2 Polyisocyanurate: modified polyisocyanurate, closed cell board to CAN/ULC-S704. Density 32 kg per cubic metre.
- .7 Sand: graded masonry sand. Clean, washed and free of pebbles and fines.

## 2.02 DOOR CORE MATERIALS

- .1 Interior doors: face sheets laminated to honeycomb core construction.
- .2 Stiffened doors: reinforce doors with vertical steel stiffeners, Laminate face sheets under pressure to stiffeners and spot weld at 150 mm OC at perimeter of door. Fill voids between stiffeners as follows and as indicated in the schedule:
  - .1 Insulation: fibreglass batt.
  - .2 Sand filled: fill core with sand after installation.
- .3 Exterior doors: face sheets laminated under pressure to insulated core. Core filled with polyisocyanurate board insulation.

## 2.03 GLASS AND GLAZING ACCESSORIES

- .1 Glazing: **Type FG:** 1 Hour fire rated, impact safety rated glazing as specified in Section 08 81 00 - Glass Glazing. For Fire rated doors and frames.
  - .1 Thickness: 23 mm thickness.
  - .2 Labeling: each pane of Fire Rated Glass to bear a permanent, non-removable label of Underwriters Laboratories and/or Intertek Testing Services (Warnock-Hersey) certifying it for use in tested and rated fire protective assemblies.
  - .3 Bite: minimum allowable bite 12.7 mm.
- .2 Glazing **Type TG:** tempered, impact safety rated glazing as specified in Section 08 81 00 - Glass Glazing. For non fire rated doors and frames.
  - .1 Thickness: 6.0 mm thickness.
  - .2 Bite: minimum allowable bite 12.7 mm.
- .3 Glazing materials: to meet fire rating and to manufacturer's recommendations.
  - .1 Setting blocks: Neoprene, EPDM or Silicone. Length of 25 mm for each square meter of glazing. Minimum 100 mm x width of glazing rabbet space minus 1.5 mm x 8 mm thick.
  - .2 Spacer shims: Neoprene or silicone. 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
  - .3 Glazing tape: Preformed butyl compound with integral resilient tube spacing device. Coiled on release paper; black colour.
  - .4 Glazing clips: manufacturer's standard type.
- .4 Glazing stops. Fabricate removable glazing stops accurately fitted, butted at corners and fastened to door and frame sections with counter-sunk stainless steel, oval head sheet metal screws.

## 2.04 ACCESSORIES

- .1 Adhesives:
  - .1 Honeycomb core and stiffened core: fire resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
  - .2 Insulated core: fire resistant, epoxy resin based, low viscosity, contact cement.
- .2 Door silencers: single stud rubber/neoprene type.
- .3 Cap: steel top and bottom caps. Install to all doors. Spot welded in place.
- .4 Thermal break: rigid polyvinylchloride extrusion.
- .5 Metallic paste filler: to manufacturer's standard.

- .6 Fire labels: metal riveted.
- .7 Sealants: exposed to interior (air seal): one part silicone based sealant to ASTM C920.
- .8 Factory Primer: rust inhibitive zinc chromate. Factory applied to all exposed surfaces where product has been welded and ground smooth.
- .9 Finish paint: site applied primer and finish paints as specified in Section 09 91 23 - Interior Painting.
- .10 Door Hardware: as specified in Section 08 71 00 - Door Hardware.

## **2.05 FABRICATION GENERAL**

- .1 Manufacture glazed frames, doors and frames in accordance with performance requirements and HMMA 802 and CSDMA Section 08 11 00.
- .2 Affix permanent metal nameplates to door and frame, indicating fire performance rating.
- .3 Manufacturer's nameplates on doors and frames are not permitted.
- .4 Conceal fastenings except where exposed fastenings are indicated.
- .5 Provide fire labeled doors and frames for those openings requiring fire protection ratings as scheduled. Test such products in strict conformance with CAN/ULC-S104, or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures or Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .6 Apply factory touch up primer at areas where zinc coating has been removed during fabrication.

## **2.06 FRAMES FABRICATION**

- .1 Interior frames: fully welded construction. Swing Type. Fabricate frames for throat openings and to profiles and maximum face sizes as indicated. Fabricate to meet specified Fire Rating.
  - .1 Minimum steel core thickness: 1.6 mm (16 ga).
  - .2 Reinforce frames with structural steel channel as required to meet design requirements.
- .2 Exterior frames: fully welded construction. Swing type. Fabricate frames for throat openings and to profiles and maximum face sizes as indicated. Thermally broken.
  - .1 Minimum steel core thickness: 1.6 mm (16 ga).
  - .2 Reinforce frames with structural steel channel as required to meet design requirements.
  - .3 Insulate exterior frame components with polyurethane insulation.
- .3 Glazed sidelights: Fixed glazed frames. Fully welded construction. Fabricate frames for throat openings and to profiles and maximum face sizes as indicated. Fabricate to meet specified Fire Rating.
  - .1 Minimum steel core thickness: 1.6 mm (16 ga).
  - .2 Fabricate frames to accept glazed panels to sizes and shapes as indicated.
- .4 Factory assemble and weld frames. Welding in accordance with CSA W59.
  - .1 Accurately mitre and mechanically joint frame corners and securely weld on inside of profile.
  - .2 Cope accurately and securely weld butt joints of vertical mullions and sills.

- .3 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .4 Securely attach floor anchors to inside of each jamb profile.
- .5 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.
- .6 Prepare frames for door silencers. 3 for single door, 2 at head for double door.
- .7 Fabricate frame products for large openings in section as large as practical to suit site restrictions. Prepare joints in frames for field splicing and assembly.
- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware and electronic hardware. Use templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware. Prepare door frames as follows:
  - .1 Heavy duty butt hinges. template hinges, 1.5 or 2 pair.
  - .2 ANSI strike.
  - .3 Reinforcing at head for door closer.
  - .4 Hole: 19 mm diameter for contact.
  - .5 Auxiliary deadbolt.
  - .6 Guard boxes at strike and hinge locations.
  - .7 Power box at head.
  - .8 Protect mortised cutouts with steel guard boxes.
  - .9 Provide three single silencers for single doors on strike side.

## **2.07 FRAME ANCHORAGE**

- .1 Provide appropriate anchorage to floor and wall construction. Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .2 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .3 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm o.c. maximum.
- .4 Conceal fastenings except where exposed fastenings are indicated.

## **2.08 DOOR FABRICATION**

- .1 Fabricate doors as required to meet specified Fire Ratings.
- .2 Minimum door thickness: 45 mm.
- .3 Exterior doors: insulated construction.
- .4 Interior doors: honeycomb or stiffened construction.
- .5 Fabricate flush steel doors, swing type. Door face sheets: Minimum 1.6 mm (16 ga).
  - .1 Fabricate doors with vertical edges mechanically inter-locked and welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish with no visible edge seams.
  - .2 Provide inverted, recessed, flush, spot welded steel channel caps to top and bottom of doors. Spot welded in place.
  - .3 Weld hardware reinforcement plates in place.
  - .4 Provide cut-outs for openings. Reinforce perimeter of openings as required.

- .5 Prepare doors to receive glazed panels as indicated. Provide removable stops.
- .6 Prepare doors to receive hardware as specified in Section 08 71 00 - Door Hardware.
  - .1 Blank, reinforce, drill doors and tap for mortised, templated hardware. Prepare for electronic hardware.
  - .2 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
  - .3 Reinforce doors where required, for surface mounted hardware.
- .7 Fabricate specialty sand filled door as follows: steel door, swing type. Flush.
  - .1 Stiffened door: face sheet: 1.6 mm thick steel.
  - .2 Vertical edges mechanically inter-locked and welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish with no visible edge seams.
  - .3 Maintain voids between vertical stiffeners clear for entire height of door to enable installation of sand into each core after installation of door on site. Provide removable inspection ports at top of door to access each vertical core across width of door.
  - .4 Ensure that cutouts for hardware do not prevent the installation of the sand into each portion of the door core.

### **Part 3 Execution**

#### **3.01 EXAMINATION**

- .1 Verify site conditions. Prior to manufacturing of doors and frames, verify openings, dimensions, tolerances, and method of attachment with other work. Verify that adjacent materials are compatible with each other.
- .2 Verify wall openings, blocking/framing and adjoining construction is complete, inspected and approved prior to beginning work of this section.
- .3 Prior to installation, verify and correct the area of floor on which the frame is to be installed and within the path of the door swing to ensure that the area is flat and will not impede the normal operation of the door.
- .4 Report immediately in writing to Consultant discrepancies in accuracy and suitability which will adversely affect the work of this Section. Ensure that openings and recesses to receive the work of this Section are within acceptable tolerances.
- .5 Commencement of installation indicates acceptance of the work of other Sections upon which work of this Section depends.
- .6 Examine rough opening prior to undertaking installation.

#### **3.02 INSTALLATION GENERAL**

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and datasheet.
- .2 Install doors and frames to CSDMA Installation Guide and to HMMA 840.
- .3 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .4 Coordinate with other trades for anchor placement.
- .5 Allow for deflection to ensure that structural loads are not transmitted to frame



- .6 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

### 3.03 FRAME INSTALLATION

- .1 Co-ordinate installation of door frames with Consultant and other trades involved to ensure that erection schedule is maintained. Turn over frames to other trades for building into masonry or gypsum board partitions.
- .2 Set frames plumb, square, level and at correct elevation. Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Caulk perimeter of frames between frame and adjacent material.
- .5 Maintain continuity of air barrier and vapour barrier.

### 3.04 ERECTION TOLERANCES

- .1 Installation tolerances of installed frame for squareness, alignment, twist and plumbness are to be no more than  $\pm 1.5$  mm in compliance with HMMA 841.
- .2 Provide even margins between doors and jambs and doors and finished floor or thresholds as follows.
  - .1 Hinge side: 1.0 mm.
  - .2 Latchside and head: 1.5 mm.
  - .3 Finished floor, sill or thresholds: 13 mm.
- .3 Adjust operable parts for correct clearances and function.

### 3.05 GLASS AND GLAZING

- .1 Perform work in accordance with door manufacturer's instructions.
- .2 Install glazing and seal into steel door and screen framing to meet performance criteria as specified.
- .3 Install fire rated glass units where indicated in the drawings.
- .4 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .5 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners. Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .6 Place glazing tape on free perimeter of glazing in same manner described.
- .7 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact. Knife trim protruding tape.

### 3.06 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation. Fill exposed frame anchors and damaged surfaces of doors and frames with metallic paste filler and sand to a uniform smooth finish.

**3.07 FINISH PAINTING**

- .1 Prepare metal frames to receive site application of primer and finish paint coatings as specified in Section 09 91 23 - Painting.
- .2 Field apply primer and finish paint coats to doors and frames as specified in Section 09 91 23 - Painting. Protect weatherstripping from paint. Apply final finish coat free of scratches or other blemishes.

**3.08 SAND FILLED DOOR INSTALLATION**

- .1 After painting and finishing operations fill core of specialty door.
- .2 Remove caps and completely fill each core of door. Allow to settle and refill to top taking measures to distribute sand throughout entire door area.

**3.09 CLEANING**

- .1 After completion, remove all tools and materials and leave site in clean condition to approval of Consultant.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.
- .2 Section 08 44 13 - Glazed Aluminum Curtain Walls.
- .3 Section 08 71 00 - Door Hardware.
- .4 Section 08 81 00 - Glass Glazing.

**1.02 SUMMARY**

- .1 Heavy Duty, prefinished, thermally broken, narrow stile, commercial aluminum entrance doors and entrance framing system fabricated from tubular aluminum sections with supplementary internal structural support framing. Shop unitized assembly of frame and doors. Shop fabricated vision glazing panels. Matching interior and exterior perimeter sills, trim, shims, and flashings. Anchors and attachment devices for secure attachment to building structure. Shop prepared for heavy duty, institutional grade entrance hardware. Complete with all accessories for completion of the system.
  - .1 Acceptable Material: Kawneer Tri Fab 540 frame.
- .2 Doors and framing system: thermally broken, pressure equalized, vented and drained assembly. Rated for moderate traffic applications.
- .3 System to provide for flush glazing while maintaining the 50 mm nominal face dimension of the vertical mullions with no projecting glass stops at horizontal members.
- .4 Tempered safety glass.
- .5 Narrow style type with 63.5 mm wide top rail and vertical stiles and 98.4 mm high bottom rail.
- .6 Door components 57.2 mm deep. Prepare for heavy duty hinges, closers, and electrical hardware.
- .7 Doors and Frames to be by same manufacturer as Curtain Wall assembly as specified in Section 08 44 13 - Glazed Aluminum Curtain Walls.

**1.03 REFERENCES**

- .1 American Architectural Manufacturers Association (AAMA).
  - .1 AAMA 609.1-09. Cleaning and Maintenance Guide for Architecturally Finished Aluminum.
  - .2 AAMA 1503-09. Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
  - .3 AAMA SFM-1-87(02). Aluminum Storefront and Entrance Manual.
- .2 American National Standards Institute (ANSI).
  - .1 ANSI Z97.1-2009. Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .3 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A276-13. Standard Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B209-10. Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

- .3 ASTM B221-12. Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .4 ASTM E283-04(2012). Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .5 ASTM E330-02(2010). Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- .6 ASTM E547-00(2009). Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
- .4 Canadian Standards Association (CSA International).
  - .1 CSA G40.20-13/G40.21-13 - General Requirements For Rolled Or Welded Structural Quality Steel / Structural Quality Steel.

#### 1.04 PERFORMANCE REQUIREMENTS

- .1 Design aluminum entrance frames and doors in exterior walls as follows:
  - .1 Design doors and entrance framing system from thermally broken aluminum extrusions.
  - .2 Expansion / Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 95 degrees C over a 12 hour period without causing detrimental effect to system components and anchorage.
  - .3 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E330 under wind load of 1.2 kPa. Submit certificate of tests performed.
  - .4 Test corner strength using a dual moment load test procedure. Provide results certified by an independent testing laboratory to ensure weld compliance and corner integrity.
  - .5 Air Infiltration: Limit air infiltration through assembly to 0.25 m<sup>3</sup>/h/m when tested to ASTM E283 at a pressure differential of 75 Pa.
  - .6 Provide continuous air barrier and vapour barrier through door system. Primarily in line with heel bead of glazing compound.
  - .7 Water Leakage: None, when tested to ASTM E547 at a pressure differential up to 700 Pa.
  - .8 Condensation resistance factor minimum CRFf = 65.5 and CRFg = 60.0 when tested in accordance with AAMA 1503.
  - .9 System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.
  - .10 System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- .2 Size glass thickness and glass unit dimensions to limits in accordance with ANSI Z97.1.

#### 1.05 SUBMITTALS

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, specifications and data sheets. Include construction details, material descriptions, dimensions of individual components and profiles,

hardware, finishes, and installation instructions for each type of door framing system, window framing system and door.

- .3 Submit manufacturer's printed product literature, specifications and data sheets.
- .4 Submit two copies of WHMIS Material Safety Data Sheets. Indicate VOC's for caulking materials during application and curing.
- .5 Submit shop drawings. Indicate each type of door and frame including locations. Provide full-size, scaled details of components. Indicate:
  - .1 Sizes of all components. Extrusion profiles. Core thicknesses of components. Cross section of each component.
  - .2 Interior trim and exterior junctions with adjacent construction.
  - .3 Junctions between combination units.
  - .4 Elevations of units. Locations of exposed fasteners.
  - .5 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.
  - .6 Location of caulking. Type, grade and quality of finishes.
  - .7 Arrangement of hardware and required clearances.
  - .8 Methods of assembly.
- .6 Submit catalogue details for each type of door and frame illustrating profiles, dimensions and methods of assembly.
- .7 Submit samples.
  - .1 Submit one 300 x 300 mm corner sample of each type door and frame.
  - .2 Submit sample showing glazing detail, reinforcement and finishes.
  - .3 Frame sample to show glazing stop, door stop, jointing detail, finish and wall trim.
- .8 Submit Test reports. Submit certified test reports showing compliance with specified performance characteristics and physical properties. Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .9 Submit Manufacturer's installation instructions.
- .10 Submit design data. Provide framing member structural and physical characteristics, calculations and dimensional limitations.
- .11 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### **1.06 QUALITY ASSURANCE**

- .1 Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- .1 Protect finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Apply temporary protection to finished surfaces.
- .2 Leave protective covering in place until final cleaning of building.

**1.08 ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install sealants when ambient temperature is less than 5 degrees C during and for a minimum of 48 hours after installation.

**1.09 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities. Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.
- .3 Divert used metal cut-offs from landfill by disposal into the on-site metals recycling bin.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Aluminum extrusions: to ASTM B221. Aluminum Association alloy AA6063-T5 or T6 temper, anodizing quality. Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish. Minimum wall thickness at any location for the main frame 0.070 inches.
- .2 Sheet aluminum: to ASTM B209. Aluminum Association alloy AA1100-H14 or AA5005-H32 or H34, anodizing quality.
- .3 Reinforcing: aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel complying with ASTM B633 for SC 3 severe service conditions. Provide sufficient strength to withstand design pressure indicated. Shaped to suit mullion sections.
- .4 Steel reinforcement: to CSA-G40.20/G40.21, grade 300 W. Shaped to suit mullion sections. Finish steel clips and reinforcing steel with hot dip galvanized zinc coating.
- .5 Formed aluminum components: of alloy and temper to match their intended function, purpose and finish.
- .6 Thermal breaks: reinforced fiberglass for vertical members. Rigid polyvinylchloride thermal break for intermediate horizontal members.
- .7 Fasteners: stainless steel to ASTM A276, 300 series or 400 series stainless steel. Cadmium plated and finished to match adjacent material. Of sufficient size and quantity to perform intended function.
- .8 Anchors, clips, and accessories: aluminum, nonmagnetic stainless steel, or zinc-coated steel complying with ASTM B633 for SC 3 severe service conditions. Provide sufficient strength to withstand design pressures. Manufacturer's standard high strength aluminum with nonstaining, nonferrous shims for aligning system components.
- .9 Flashings: aluminum or stainless steel concealed fastening method.
- .10 Isolation coating: alkali resistant bituminous paint or epoxy resin solution.
- .11 Sealants: as specified in Section 07 92 10 - Joint Sealants. Colour selected by Consultant.
  - .1 For sealant required within fabricated components, provide permanently elastic, non-shrinking, and non-migrating type recommended by manufacturer for joint size and movement.

## 2.02 HARDWARE

- .1 Hardware: as specified in Section 08 71 0 - Door Hardware.
  - .1 Hinges: Provide 1.5 pair per door. Heavy duty hinges to manufacturer's heavy duty standard. Finished to match doors and frame.
  - .2 Cylinder: to match building system. To approval of Consultant. Key to match building masterkey system to approval of Consultant.
  - .3 Closer: overhead, barrier free door operator exposed
  - .4 Threshold: extruded aluminum. 12.5 mm high x 114 mm wide. Full width of door opening.
  - .5 Exit devices and hold open devices: as specified in Section 08 71 10 - Door Hardware.
  - .6 Weatherstrip: thermoplastic elastomer weathering in a tubular shape with a semi-rigid polymeric backing. Replaceable. Meeting stiles on pairs of doors provided with adjustable astragal utilizing wool pile with a polymeric fin.
  - .7 Door Bottom Sweep Strips: EPDM blade gasket sweep strip in an anodized aluminum extrusion. Applied to the interior exposed surface of the bottom rail with concealed fasteners. Adjustable.

## 2.03 GLASS AND GLAZING

- .1 Glazing: **Type TG** as specified in Section 08 81 00 - Glass Glazing. 12 mm thick, tempered safety glass.
- .2 Glazing gaskets: manufacturer's standard extruded, black EPDM elastomeric extrusions or a thermoplastic elastomer. Durometer hardness appropriate to intended function. Provide adjustable glass positioning blocks to help center the glass in the door opening. Reinforced with non-stretchable cord.
- .3 Glazing stops: 1.6 mm thick flush, interlocking hook-in type to accept dry glazing gaskets. Tamperproof type. Stops to accommodate various glass thicknesses.
- .4 Setting blocks: Neoprene, EPDM or Silicone, 80-90 Shore A durometer hardness to ASTM D2240. Length of 25 mm for each square meter of glazing. Minimum 100 mm x width of glazing rabbet space minus 1.5 mm x 8 mm thick.
- .5 Bond breaker tape: manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

## 2.04 ALUMINUM DOORS

- .1 Construct narrow style thermally broken doors of porthole extrusions with minimum wall thickness of 3.2 mm. Thermal cladding cover profile minimum wall thickness of 1.5 mm. Construct doors of dual moment corner construction with fillet welds to reinforce the corner junctions.
- .2 Door thickness nominal 57.2 mm plus or minus 6 mm.
- .3 Door stiles nominal 63.5 mm wide plus or minus 6 mm.
- .4 Top rail nominal 63.5 mm wide plus or minus 6 mm.
- .5 Bottom rail nominal 98.4 mm wide plus or minus 6 mm.
- .6 Reinforce and plug weld corners using heavy duty extruded aluminum corner keys to ensure maximum strength. Mechanically-joined corners of doors to produce sturdy door unit.

- .7 Reinforce mechanically-joined corners of doors to produce sturdy door unit. Dual moment welded corner construction to consist of mechanical clip fastening, SIGMA deep penetration plug welds and 29 mm long fillet welds inside and outside of all four corners.
- .8 Provide thermal break to separate interior and exterior door and frame components. Apply thermal breaks to the interior side of door structure with screws spaced not more than 247.7 on center. Interlock aluminum cladding with separators at both edges and mechanically secured to door without adhesives. Ensure no metal to metal contact, direct or indirect, between the cladding or the cladding attachments and the door structure. Secure thermal cladding to doors using concealed screws and interlocking components.
- .9 Prepare for heavy duty hinges, closers, and electrical hardware.
- .10 Provide doors and prepare for installation into Curtain Wall Framing as specified in Section 08 44 13 - Glazed Aluminum Curtain Walls.
- .11 Finish: factory painted as specified below.

## **2.05 ALUMINUM ENTRANCE FRAMING**

- .1 Construct entrance framing of thermally broken aluminum extrusions with interior tubular section insulated from exterior. Minimum wall thickness of 3.0 mm.
- .2 Frame members: 114.9 x 51.6 mm nominal size. Snap on glazing stops. Flush glazing with no projecting glass stops at horizontal or vertical members. Provide drainage holes; internal weep drainage system.
- .3 Sill: construct sill of extruded aluminum profiles with matching aluminum cladding to raise glass line above floor level as indicated.
- .4 Fabricate frames with screw spline corner construction or stick system with shear block.
- .5 Anchor frame members which function primarily as glass holding assemblies with standard frame clips and machine screws. Glazing framing members and doors shall provide for fully resilient glass settings.
- .6 Fabricate frame with fiberglass rolled in thermal break for vertical members and PVC rolled in thermal break for intermediate horizontal members. Provide a mechanical interlock between the thermal break and the aluminum extrusion allowing the composite vertical sections assembly to act as an integral structural unit.
- .7 Accurately fit and secure joints and corners. Make joints hairline in appearance.
- .8 Finish: factory painted as specified below.

## **2.06 ALUMINUM FINISHES**

- .1 Painted finish meeting AAMA 2605. Properties as follows:
  - .1 Dry film thickness: to ASTM D7091. 1.2 mil.
  - .2 Pretreatment: multi stage cleaning with chrome phosphate conversion coating at 40 mg per square foot minimum.
  - .3 Dry film hardness: to ASTM D3363. F minimum.
  - .4 Impact resistance: 1/10 inch deformation. No loss of adhesion.
  - .5 Abrasion resistance: to ASTM D698. Coefficient of 40 minimum.
  - .6 Color retention: 10 years south Florida. Maximum 5 delta E.
  - .7 Gloss retention: minimum 50 % after 5 years south Florida.
  - .8 Corrosion resistance: 4000 hours. Humidity / salt spray.



- .9 Salt spray: to ASTM G85. 2000 hours. Annex A5: Scribe or cut edges: Rating 7. Field rating 8.
- .10 Humidity resistance: to ASTM D2247 or ASTM D4585. 4000 Hours. Few number 8 Blisters Maximum.
- .11 10 % muriatic acid spot test. 15 minutes. No blistering or visual change.
- .12 Mortar (alkali) resistance: 24 hour spot test. No visual change.
- .13 72 hour detergent immersion at 100 degrees F: No loss of adhesion.
- .14 Boiling water adhesion: no removal of film after 20 min. exposure.
- .15 Chalking resistance: no more than number 8. Number 6 for whites.
- .16 Erosion resistance: less than 10 % after 10 years south Florida.
- .17 PVDF content: minimum 70 % by volume weight into the paint system. Kynar 500 or Hylar 5000 resins plus durable ceramic pigments.
- .18 Colour: White. Selected by Consultant from full and extended range of available colours.
- .19 Gloss: to ASTM D523. Low and Medium. Gloss level will be selected by Consultant.
- .2 Pretreatment. Thoroughly clean using a multi stage cleaning process to remove organic and organic surface soils and residual oxides.
- .3 Apply a chemical conversion coating to which organic coatings will firmly adhere.
- .4 Factory apply primer to a thickness of 0.2 - 0.3 mils.
- .5 Factory apply paint and oven bake for a topcoat film thickness of 1.0 mil minimum.

## 2.07 FABRICATION

- .1 Doors and entrance framing to be by same manufacturer. Same manufacturer as curtain wall system as specified in Section 08 44 13 - Glazed Aluminum Curtain Walls.
- .2 Fabricate doors and frames to profiles and maximum face sizes as shown. Provide minimum 22 mm bite for glazed units.
- .3 Reinforce framing members for imposed loads.
- .4 Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- .5 Accurately machine joints in aluminum framing to allow site assembly and sealing. Make joints flush, hairline, and weatherproof. Ensure neat weathertight connections. Fit joints tightly and secure mechanically.
- .6 Prepare components to receive anchor devices. Fabricate anchors. Arrange fasteners and attachments to conceal from view.
- .7 Prepare components with internal reinforcement for door hardware. Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08 71 10 - Door Hardware.
- .8 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.
- .9 Manufacturer's nameplates on doors and frames are not permitted.

**Part 3 Execution**

**3.01 MANUFACTURER'S INSTRUCTIONS**

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

**3.02 EXAMINATION**

- .1 Verify existing conditions before starting work. Verify dimensions, tolerances, and method of attachment with other work. Verify wall openings and adjoining air and vapour seal materials are ready to receive work of this Section.

**3.03 INSTALLATION**

- .1 Install door and entrance system to manufacturer instructions.
- .2 Install system in accordance with manufacturer's instructions and AAMA SFM - Aluminum Storefront and Entrance Manual.
- .3 Set frames at correct elevation in alignment with adjacent work. Align assembly plumb, square and level, free of warp or twist. Maintain assembly dimensional tolerances.
- .4 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Provide alignment attachments and shims to permanently fasten system to building structure. Provide clearances for deflection of structure to ensure that structural loads are not transmitted to frames.
- .5 Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly.
- .6 Install sill and flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- .7 Coordinate attachment and seal of perimeter air and vapour barrier materials.
- .8 Install doors and hardware in accordance with hardware templates and manufacturer's instructions. Adjust operable parts for correct function.
- .9 Set thresholds in bed of mastic and secure.
- .10 Install hardware using templates provided in accordance with Section 08 71 00 - Door Hardware. Adjust operating hardware for smooth operation.

**3.04 ERECTION TOLERANCES**

- .1 Maximum variation from plumb: maximum 1.5 mm/m. Non-cumulative or maximum 1.5 mm per 3 m, whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: maximum 0.8 mm.

**3.05 GLAZING**

- .1 Glaze aluminum doors and entrance framing in accordance with manufacturer's instructions as required to achieve performance criteria.

**3.06 CAULKING**

- .1 Seal joints to provide weathertight seal at outside and air, vapour seal at inside.
- .2 Apply sealant in accordance with Section 07 92 10 - Joint Sealants. Conceal sealant within the aluminum work except where exposed use is permitted by Consultant.

- .3 Install backing materials and perimeter sealant in accordance with Manufacturer's recommended methods as required to achieve performance criteria.

**3.07 CLEANING**

- .1 Remove protective material from pre-finished aluminum surfaces.
- .2 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- .3 Remove traces of primer, caulking, epoxy and filler materials. Remove excess sealant by method acceptable to sealant manufacturer
- .4 Perform cleaning of aluminum components in accordance with AAMA 609.1.
- .5 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .6 Clean glass and glazing materials with approved non-abrasive cleaner.
- .7 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .8 Protect installed product's finish surfaces from damage during construction. Protect aluminum entrances from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants. Remove and replace damaged aluminum entrances at no extra cost.

**END OF SECTION**

**Part 1 General**

**1.01 SUMMARY**

- .1 Flush, fire rated and non fire rated solid core wood doors in solid wood frames or hollow metal frames. Matching transom panels.

**1.02 RELATED SECTIONS**

- .1 Section 06 20 00 - Finish Carpentry.
- .2 Section 08 11 00 - Metal Doors and Frames.
- .3 Section 08 71 00 - Door Hardware.
- .4 Section 08 81 00 - Glass Glazing.
- .5 Section 09 91 23 - Painting.

**1.03 REFERENCES**

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
  - .1 AWS. Architectural Woodwork Standards. Second Edition 2014.
- .2 Hollow Metal Manufacturers Association (HMMA).
  - .1 HMMA 840-07. Installation and Storage of Hollow Metal Doors and Frames.
- .3 National Fire Protection Association (NFPA).
  - .1 NFPA 80-2013. Standard for Fire Doors and Other Opening Protectives.
  - .2 NFPA 252-2012. Standard Methods of Fire Tests of Door Assemblies.
- .4 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN/ULC-S101-07-EN. Standard Methods Of Fire Endurance Tests Of Building Construction And Materials.
  - .2 CAN/ULC-S104-10-EN. Standard Method for Fire Tests of Door Assemblies.
  - .3 CAN/ULC-S105-09-EN. Standard Specification For Fire Door Frames Meeting The Performance Required By CAN/ULC-S104.
- .5 Window & Door Manufacturers Association (WDMA).
  - .1 I.S 1A-11. Industry Standard for Architectural Wood Flush Doors.

**1.04 PERFORMANCE REQUIREMENTS**

- .1 Provide Doors in accordance with the following Classifications as defined by WDMA I.S. 1A and AWS Section 9.
  - .1 Performance Duty Level: Heavy Duty.
  - .2 Aesthetics: Premium.
- .2 Provide fire rated door and frame assembly conforming to NFPA 80 for fire rated class as indicated in the Door and Frame Schedule. Minimum rating: as indicated in the Schedule.
- .3 Fire rated doors and frames: labeled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 and NFPA 252 for ratings as scheduled.

- .4 Provide fire labeled frames and doors for those openings requiring fire protection ratings and as scheduled. Test products in strict conformance with CAN/ULC-S104 or NFPA 252 and list by nationally recognized agency having factory inspection service. Construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

#### 1.05 SUBMITTALS

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's product data sheet. Submit manufacturers standard product literature on doors, frames, accessories and glazing. Submit manufacturer's specifications. Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's for caulking materials during application and for adhesives.
- .3 Submit shop drawings.
  - .1 Provide elevations of each door and frame. Indicate details of internal construction, frame anchor types, closure methods, location of cut-outs for hardware and glazing panels.
  - .2 Indicate each type of door material, thicknesses, mortises, reinforcements, location of exposed fasteners, openings for hardware and glazing panels, arrangement of hardware. Indicate factory finishes. Indicate fire rating for each door.
  - .3 Indicate each type of frame material, details of wood construction, steel core thickness, reinforcements, location of anchors and exposed fastenings and reinforcing. Indicate finishes.
  - .4 Indicate details of wood trim. Indicate profiles of wood, jointing, fastening and other related details. Provide full size details of all profiles. Indicate all materials, thicknesses and finishes. Indicate typical and special installation conditions, all connections, attachments, anchorage and location of exposed fastenings. Indicate shop applied and site applied finishes.
  - .5 Indicate details for each type of glazing panel. Thickness, type of glass, details for installation into doors, details and information on glazing compounds and materials. Details for fixed and applied stops.
- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .5 Submit Certified Test Reports indicating compliance with fire ratings for door and frame assemblies.
  - .1 Test doors are required to be similar to the project doors. Door panel areas for the project doors are required to be within 5% of the test doors.
  - .2 Submit Test reports based on a complete operable assembly. Assembly to be tested complete with frame, hinges, latching hardware and glazing panels.
  - .3 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .6 Submit manufacturer's installation instructions.
- .7 Submit samples.
  - .1 Submit one 300 x 300 mm corner sample of each type door. Show cutout for glazing. Include details of door core construction.
  - .2 Submit one 300 x 300 mm corner sample of each type of frame. Show cutout for butt hinges.

- .3 Submit one 300 x 300 mm corner sample of glazing panel. Include samples of applied stops and all glazing tapes and gaskets.
- .4 Submit one sample of all anchors and clips.
- .5 Submit duplicate 300 mm long samples of each solid hardwood component including door edging in specified finishes.
- .8 Closeout Submittals: Provide maintenance data for doors, frames and hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

#### 1.06 QUALITY ASSURANCE

- .1 Manufacturer Qualifications. Door manufacturer who is regularly engaged in the design, manufacture, fabrication, finishing and installation of custom, premier quality, fire rated, glazed wood doors and wood and steel frames of institutional complexity and scope. Manufacturer to provide written documentation to demonstrate to the satisfaction of the Consultant that they have successfully performed on comparable projects for a minimum period of ten years.

#### 1.07 MOCK-UP

- .1 Construct Mock-Up in accordance with Section 01 45 00 - Quality Control.
  - .1 Prepare a Mock-Up of door installation on-site, where directed by Consultant.
  - .2 Schedule construction of Mock-Up to ensure attendance of Consultant during preparation and installation. Provide minimum of 72 hours written advance notice to Consultant.
  - .3 Ensure blocking and structural framing is in place prior to Mock-Up preparation.
  - .4 Install door and frame as per reviewed shop drawings.
  - .5 Install interior trim and touch-up where required or directed by Consultant.
  - .6 Install complete package of door hardware including lockset, closer and electronic latch devices.
  - .7 Approved Mock-Up may form part of final Work.
  - .8 Consultant will arrange for Field Testing of Mock-Up. Testing will determine acceptability of door and frame assemblies and evaluate installation procedures and tolerances. Accepted Mock-Up will serve as the standard of acceptance for all Door installations and will be used to determine acceptability and workmanship for all installations.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- .1 Transport, handle, store, and protect products in accordance with Section 01 61 00 - Common Product Requirements and as per manufacturer's written instructions.
- .2 Comply with HMMA 840.
- .3 Protect units against damage from the elements, construction activities and other hazards before, during, and after installation.
- .4 Provide temporary protection for exposed surfaces. Individually wrap and crate each door for transport to site. Brace frames to maintain squareness and rigidity during shipment and installation.
- .5 Handle and store material in such a manner that no damage will be done to the materials or to the work of other Sections.
- .6 Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.

- .7 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed. Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
- .8 Protect doors from scratches, handling marks and other damage. Wrap doors until installation. Store doors away from direct sunlight.
- .9 Store doors in horizontal position, frames in vertical position, spaced with blocking to permit air circulation between components. Store doors between 10 to 32 degrees C and 25 to 55 percent relative humidity.
- .10 Store materials out of water and covered to protect from damage. Use covering that allows air circulation and does not permit light to penetrate.
- .11 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer for metal surfaces. Repair scratches to wood surfaces as recommended by Manufacturer.
- .12 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. Remove from site and dispose of packaging materials at appropriate recycling facilities. Divert unused metal materials from landfill to metal recycling facility. Divert unused wood materials from landfill to recycling facility. Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

## **1.09 WARRANTY**

- .1 Provide a written guarantee stating that the work of this Section shall remain free of defects in materials and workmanship for a period of five years after substantial performance of the Work. Warrant that work will be structurally sound and free from distortion and deformation, that sealants and glazing will be free from deterioration and that all hardware shall remain free of defects and functional during the warranty period.

## **Part 2 Products**

### **2.01 MATERIALS**

- .1 Steel Door Frames: welded steel frames as specified in Section 08 11 00 - Metal Doors and Frames.
- .2 Wood Door Frames: solid hardwood frames as specified in Section 06 20 00 Finish Carpentry.
- .3 Hardwood Lumber: to AWMAC AWS Manual. Birch, premium, select grade. Clear pieces. Well matched for uniform colour and grain. Kiln dried to a maximum average moisture content 6 - 8 % at time of fabrication. No knots, pinholes, sap pockets or other visible defects. Heartwood only, no sapwood will be permitted.

### **2.02 ACCESSORIES**

- .1 Door Hardware: as specified in Section 08 71 00 - Door Hardware.
  - .1 Hinges: heavy duty templated butt hinges.
  - .2 Electronic components: operating and monitoring devices.

### **2.03 GLAZING**

- .1 Tested as a complete assembly to meet specified fire rating. Glazing panels to be factory supplied and preinstalled.

- .2 Glazing for Fire Rated Doors: Type FG as specified in Section 08 11 00 - Glass Glazing. Thickness: 23 mm.
  - .1 Labeling: each pane of Fire Rated Glass to bear a permanent, non-removable label of Underwriters Laboratories and/or Intertek Testing Services (Warnock-Hersey) certifying it for use in tested and rated fire protective assemblies.
  - .2 Bite: minimum allowable bite 12.7 mm.
- .3 Glazing for Non Fire Rated Doors: Type TG as specified in Section 08 11 00 - Glass Glazing. Thickness: 6 mm.
- .4 Glazing materials: to meet fire rating and to manufacturer's recommendations.
  - .1 Setting blocks: Neoprene, EPDM or Silicone. Length of 25 mm for each square meter of glazing. Minimum 100 mm x width of glazing rabbet space minus 1.5 mm x 8 mm thick.
  - .2 Spacer shims: Neoprene or silicone. 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
  - .3 Glazing tape: Preformed butyl compound with integral resilient tube spacing device. Coiled on release paper; black colour.
  - .4 Glazing stops: manufacturer's standard type. Fabricate removable glazing stops accurately fitted, butted at corners and fastened to door and frame sections.
  - .5 Glazing Compounds: polychloroprene vinyl sealant, fire resistant.

#### 2.04 FABRICATION GENERAL

- .1 Manufacture doors and frame assemblies to obtain fire ratings as indicated in the Door and Frame Schedule.
- .2 Provide fire labeled frames for those openings requiring fire protection ratings as scheduled. Test such products in strict conformance with CAN/ULC-S104, or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures or Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .3 Factory install all glazed panels. Accurately machine openings in doors and insert prefabricated glazed panels. Install fixed stops and secure to door.

#### 2.05 WOOD FLUSH DOORS

- .1 Solid core: flush wood doors to WDMA I.S. 1A and AWS Manual, Section 9 and as follows: Minimum 5 ply construction.
  - .1 Performance Duty Level: Heavy Duty.
  - .2 Aesthetic Grade: Premium.
  - .3 Core Type: staved lumber type (SLC) or structural composite lumber type (SCLC). Cross bands: high density fiberboard.
  - .4 Hardware blocking: solid blocking at all hardware locations.
  - .5 Face panel: MDO for opaque painted finish.

#### 2.06 TRANSOM AND SIDE PANELS

- .1 Construction: to match adjacent door.
- .2 Meeting edges of doors and transom panels: rabbeted.
- .3 Face panel: to match adjacent door.



**2.07 DOOR FABRICATION**

- .1 Provide solid lumber, vertical edge strips to all exposed door edges. Bond vertical and horizontal edges to the door core. Vertical edges shall be smoothly sanded, free of knife and saw marks. Voids are not permitted between face panel layers and solid wood edges. The hinge edge may be jointed. Joints must be tight.
- .2 Provide vertical edges with an eased edge at intersections of edges and face panel.
- .3 Prepare doors for glazing. Provide solid hardwood glazing stops. Provide with mitred corners.
- .4 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.
- .5 Seal all surfaces against moisture, including door edges.
- .6 Radius vertical edges of double acting doors to 60 mm radius.

**2.08 FRAME FABRICATION**

- .1 Wood Door Frames: fabricated from solid hardwood as specified in Section 06 20 00 - Finish Carpentry.
  - .1 Provide hardwood frames where indicated in the Schedule.
  - .2 Fabricate frames to sizes and profiles as indicated.
  - .3 Reinforce frames with steel plates and angles as required to support weight of doors.
  - .4 Provide stops, trim and casing to match and as detailed to complete the assembly.
- .2 Steel Door Frames. fabricated from steel components as specified in Section 08 11 00 - Metal Doors and Frames.
  - .1 Provide steel frames where indicated in the Schedule.
  - .2 Swing Type.
  - .3 Fabricate frames for throat openings and to profiles and maximum face sizes as indicated.

**2.09 FINISHING**

- .1 Finish doors and panels as follows:
  - .1 Sand with progressively finer grits up to 220 grit sandpaper.
  - .2 Prepare for application of paint on site as specified in Section 09 91 23 - Painting.

**Part 3 Execution**

**3.01 MANUFACTURER'S INSTRUCTIONS**

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

**3.02 EXAMINATION**

- .1 Verify site conditions. Prior to manufacturing of doors and frames, verify openings, dimensions, tolerances, and method of attachment with other work. Verify that adjacent materials are compatible with each other.
- .2 Verify wall openings, blocking/framing and adjoining construction is complete, inspected and approved prior to beginning work of this section.

- .3 Prior to installation, verify and correct the area of floor on which the frame is to be installed and within the path of the door swing to ensure that the area is flat and will not impede the normal operation of the door.
- .4 Verify flatness of floor where threshold will be installed is clean clear and level within tolerances established by Door Manufacturer. Correct irregularities to within 0.5 mm of established tolerances.
- .5 Report immediately in writing to Consultant discrepancies in accuracy and suitability which will adversely affect the work of this Section.
- .6 Examine rough opening prior to undertaking installation. Ensure that openings and recesses to receive the work of this Section are within acceptable tolerances for level, plumb, square, alignment and twist.
- .7 Commencement of installation indicates acceptance of the work of other Sections upon which work of this Section depends.

### 3.03 INSTALLATION

- .1 Unwrap and protect doors in accordance with Manufacturer's instructions.
- .2 Allow for deflection to ensure that structural loads are not transmitted to frame.
- .3 Install labelled fire rated doors and frames to NFPA 80.
- .4 Set frames plumb, square, level and at correct elevation. Secure anchorages and connections to adjacent construction.
- .5 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .6 Caulk frame and threshold continuously around perimeter of frame on both sides at frame/wall interface.
- .7 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 10 - Door Hardware.
- .8 Maintain the following door clearances:
  - .1 Hinge: 3 mm between door and frame.
  - .2 Latch: 5 mm between door and frame.
  - .3 Header: 5 mm between door and frame.
  - .4 Threshold: 5 mm between door and threshold when the threshold is level.
  - .5 Between pairs of doors: 5 mm with one door being inactive.
- .9 Secure transom by means of stops. Use concealed fasteners or countersunk screws concealed by means of wood plugs matching panel in grain and colour.

### 3.04 ADJUSTMENT

- .1 Re-adjust doors and hardware just prior to completion of building to function freely and properly. Adjust door closer and electronic latch devices to ensure full and complete closure.

### 3.05 FINISH PAINTING

- .1 Field apply primer coats and finish paint coats to doors and frames. Apply final finish coat free of scratches or other blemishes.
- .2 Prepare metal frames to receive application of finish paint in accordance with Section 09 91 23 - Painting.

- .3 Prepare wood doors and frames to receive application of paint in accordance with Section 09 91 23 - Painting.

**3.06 CLEANING**

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt. Remove traces of primer and caulking. Clean doors and frames. Clean glass and glazing materials with approved non-abrasive cleaner.
- .2 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**PART 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.
- .2 Section 08 81 00 - Glass Glazing.

**1.02 SUMMARY**

**1.03 REFERENCES**

- .1 American Architectural Manufacturers Association (AAMA).
  - .1 AAMA 611-14. Voluntary Specification for Anodized Architectural Aluminum.
- .2 American National Standards Institute (ANSI).
  - .1 ANSI Z97.1-2015. Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .3 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM B209-14. Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - .2 ASTM B221-14. Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - .3 ASTM C1048-12e1. Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- .4 Canadian Standards Association International (CSA).
  - .1 CAN/CSA-B651-12. Accessible Design for the Built Environment.

**1.04 DESIGN REQUIREMENTS**

- .1 Design glass panels to withstand their own weight, weight of sliding doors, loads imposed by motion of operable elements and design loads as calculated in accordance with NBC.
- .2 Design system to accommodate movement in doors and between fixed components of system and building structure, caused by structural movements, and dynamic loading and release of loads, without permanent distortion, damage to glass panels or breakage of seals.
- .3 Accommodate dimensional distortion of components during operation.

**1.05 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, fabrication details, operational descriptions and finishes. Include data for each component, including glass panels, track and carriers, door hardware and accessories.
- .3 Submit manufacturer's shop drawings.
  - .1 Indicate dimensions of members and sill conditions, materials, finishes, recesses, anchors and reinforcements, provisions for expansion and contraction, methods of joining and joint locations, glass types and glass thicknesses, glazing details, types of sealants, details of other pertinent components of the work, and adjacent construction

- to which work of this section is attached. Include details of reinforcement, anchor types and locations.
- .2 Include layout plans, elevations, sections, and details. Indicate sizes of all door panels. Use glass type designations. Include locations and requirements for attachment to other work.
  - .3 Include details for door hardware. Include locations, arrangement and mounting heights, and installation requirements. Indicate cut outs for hardware. Indicate location of exposed fasteners. Indicate factory finishes.
  - .4 Identify installation tolerances required, assembly conditions, locations of operating components.
  - .5 Indicate sizes of fixed glazing panels. Indicate details for each glazing panel. Thickness, type of glass, details for installation. Include details and information for glazing compounds and materials. Provide details for fixed and applied stops.
  - .6 Indicate details for each type of seal, threshold and applied gasketing.
- .4 Provide samples.
- .1 Submit duplicate 300 mm long sections of aluminum extrusions. Submit samples of typical fabricated sections, indicating joints, exposed fastenings, quality of workmanship and finish.
  - .2 Submit duplicate 300 x 300 mm samples of each type of glass. Include finishes of exposed edges.
  - .3 Submit one of each type of exposed door hardware item.
  - .4 Submit 600 mm length of manufacturer's track assembly. Standard size, with carrier.
- .5 Submit manufacturer's installation instructions.
- .6 Closeout Submittals: Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .1 Provide manufacturers operating and maintenance manuals for each item comprising the complete door installation. Include the name, address, and contact information of the manufacturers providing the hardware and the nearest service representatives.
  - .2 Submit manufacturer's parts lists. Include servicing frequencies, instructions for adjustment and operation applicable to each type of component or hardware.

#### **1.06 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications. Manufacturer who is regularly engaged in the design, manufacture, fabrication, finishing and installation of custom, sliding glass door assemblies. Manufacturer to provide written documentation to demonstrate to the satisfaction of the Consultant that they have successfully performed on comparable projects for a minimum period of ten years. Manufacturer to have a proven record of successful in-service performance.
- .2 Installer Qualifications: Trained by the product manufacturers, with a minimum 3 years documented experience installing and maintenance of units similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- .3 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements and manufacturer's installation instructions.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

- .2 Store inside building in dry protected area away from construction activity. Protect finish surfaces from damage during handling, erection and at point of installation.
- .3 Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **1.08 MAINTENANCE MATERIALS**

- .1 Provide maintenance materials of in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide wrenches and tools required for maintenance of equipment. Deliver to Consultant upon completion of the work of this section. Store where directed by Consultant.

### **PART 2 Products**

#### **2.01 SLIDING SYSTEMS**

- .1 Interior application. Overhead mounted, single operable sliding glass door panel and fixed, floor to ceiling glass wall panel sidelight assemblies. Single direction, manual operation sliding doors. Doors to travel on fixed guide tracks.
- .2 Sliding mechanism includes a compact, exposed guide track assembly with the roller assembly hidden inside. Guide system and door carriers are surface mounted to the face of adjacent floor to ceiling glass sidelights.
- .3 Acceptable Material: Dorma AGILE 150 interior sliding glass door assemblies.

#### **2.02 MATERIALS**

- .1 Extruded aluminum: strength and durability to ASTM B221. Alloy 6063-T5.
- .2 Aluminum sheet: to ASTM B209. Alloy and temper as required for type of use and finish indicated for Aluminum finish designation.
- .3 Fasteners: aluminum, non magnetic stainless steel, cadmium plated steel, or other non-corrosive metal fasteners compatible with aluminum components, hardware, anchors and other items being fastened. For exposed fasteners (for hardware only), provide Phillips flat head screws with finish matching item being fastened.
- .4 Glass panels: provide glass panels that comply with ANSI Z97.1 Class A requirements for safety glazing. Permanently mark glazing with certification label.
  - .1 Clear float glass: ASTM C1048. Kind FT - Fully Tempered. Condition A - uncoated Surfaces. Thickness: 8.0 mm.
  - .2 Fully temper glass using horizontal (roller hearth) process. Fabricate so that when glass is installed, roll wave distortion is parallel with bottom edge of door or lite.
  - .3 Edges: exposed edges machine ground and flat polished.
  - .4 Sizes: door panels and sidelights of size indicated on drawings.

#### **2.03 SLIDING DOOR ASSEMBLIES**

- .1 Accessibility: comply with applicable provisions of CAN/CSA-B651 and requirements of authorities having jurisdiction.
- .2 Sliding door track: full width, extruded aluminum track with end caps, 63 mm high. Designed for operation, size and weight of glass panel door. Factory finished track with concealed clamping roller carriers, integrated end of travel stops and floor guide.

- .1 Finish: anodized finish to AAMA 611, Architectural Class II. Minimum thickness: 0.010 mm. Clear designation AA-M12C22A41. No 14. Match No. 4 satin brushed stainless steel.
- .2 Mounting: partition opening top jamb mounted.
- .3 Door panel carriers: Manufacturer's standard carrier assembly. Concealed trolley system designed for operation, size and weight of glass panel door. Ball bearing wheels and clamp on attachment to glass panels requiring no glass penetration. Field adjustable for vertical adjustment.
- .3 Sidelights: captured by U channels integrated with door top track assembly. Bottom of sidelights held within dry gasket glazing channel as indicated.

## **2.04 DOOR HARDWARE**

- .1 Provide door manufacturer's standard heavy duty hardware items as indicate and required for operation of each door, including the following items. Provide hardware in size, number and type recommended by manufacturer. Mounting location recommended by manufacturer.
- .2 Handles: Dorma Manet M21 Series. Back to back handles. Stainless steel. Length 720 mm. 25 mm diameter handle, 520 mm centres. Model number: M21.270.

## **2.05 FABRICATION**

- .1 Fabricate sliding doors and fixed glazed panels by same manufacturer.
- .2 Fabricate doors as packaged units complete with door hangers, guide rails and related components including hardware and accessories. Shop install hardware, except surface mounted hardware. Remove as required for delivery and installation of work at project site.
- .3 Fabricate glass door assemblies in sizes, profiles and configurations shown on Drawings.
- .4 Provide holes and cutouts in glass to receive hardware, fittings and accessories prior to tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
- .5 Conceal fastenings from view. Exposed fastenings where specified or indicated.
- .6 Install replaceable weatherstripping at door openings at head and meeting points. Adjust to prevent door from closing incorrectly or to prevent binding.
- .7 Manufacturer's nameplates are not permitted.

## **PART 3 Execution**

### **3.01 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written product data sheets including product technical bulletins, product catalogue installation instructions and product carton installation instructions. Comply with approved Shop Drawings.
- .2 Co-ordinate installation of the glass door assemblies with the installation of glass wall components to ensure compliance with tolerance requirements of supporting components. Co-ordinate the installation of anchors and blocking indicated on approved shop drawings.

### **3.02 EXAMINATION**

- .1 Examine door opening to determine if work is within manufacturer's required tolerances and ready to receive work. Examine for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance.
- .2 Proceed only after such discrepancies or conflicts have been resolved.

### 3.03 INSTALLATION

- .1 Do not install damaged components. Rigidly secure non movement joints.
- .2 Install glass door assemblies after other finishing operations have been completed. Coordinate installation of recesses housings with installation of adjacent finishes.
- .3 Secure components to building structure using manufacturer's recommended fasteners suitable for application. Install floor guides and track stops. Set headers, carrier assemblies, tracks and guides level and true to location with anchorage for permanent support.
- .4 Attach glass panels to track carriers and adjust panels to level, plumb, and true to line with uniform clearances as recommended in writing by manufacturer. Install system without warp or rack of glass members. Anchor securely in place.
- .5 Install surface mounted hardware using concealed fasteners to greatest extent possible.
- .6 Glazing: Glaze fixed and sliding glass panels in accordance with the Glass Association of North America (GANA) Glazing Manual, published recommendations of glass product manufacturer, and published instructions of system manufacturer.
- .7 Set thresholds, bottom guide and track systems and framing members in full bed of sealants.
- .8 Seal perimeter of framing members with sealant. Conceal sealant within aluminum work except where exposed use is permitted.

### 3.04 ADJUSTING

- .1 After repeated operation of completed installation equivalent to three days of use by normal traffic (100 to 300 cycles), readjust door operators for optimum, smooth operating condition and safety. Lubricate hardware, operating equipment and other moving parts.
- .2 Adjust sliding doors and hardware to produce smooth operation and uniform fit.
- .3 Replace damaged glass panels and accessories.

### 3.05 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt. Clean adjacent surfaces soiled by installation.
- .2 Clean glass panels in accordance with glass manufacturer's written instructions. Do not use cleaning agents or methods not approved by glass manufacturer.
- .3 Clean glass and metal surfaces promptly after installation. Remove excess sealants, compounds, dirt and other substances. Repair damages finish to match original finish.
- .4 Clean aluminum surfaces. Exercise care to avoid damage to coatings. Remove protective material from prefinished aluminum surfaces.
- .5 Wash exposed surfaces with mild solution of detergent and warm water, using soft, clean wiping cloths. Remove dirt from corners. Wipe surfaces clean.
- .6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

### 3.06 DEMONSTRATION

- .1 Engage a factory-authorized representative to train maintenance personnel to adjust, operate, and maintain safe operation of the door.

**END OF SECTION**



**Part 1 General**

**1.01 RELATED SECTION**

- .1 Section 09 21 16 - Gypsum Board Assemblies.

**1.02 REFERENCES**

- .1 National Fire Protection Association. (NFPA).
  - .1 NFPA 252-2012: Standard Methods of Fire Tests of Door Assemblies.
  - .2 NFPA 288-2012: Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies.

**1.03 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's instructions, printed product literature and data sheets for access door components. Include construction details, fire ratings, materials, individual components and profiles, and finishes. Include product characteristics, performance criteria, physical sizes. Submit catalogue details.
- .3 Submit Shop Drawings. Include plans, elevations, sections, details, and attachments to other work. Submit details for fabrication and installation of access doors and frames for each type of substrate. Show location and types of all Architectural Access Doors. Indicate type of door, profiles, dimensions and methods of assembly. Provide door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- .4 Submit samples. Submit one sample of each type of Architectural Access Door. Submit one 300 x 300 mm corner sample of each type of door. Provide sample of key mechanism and concealed touch latch mechanism. Approved samples will be returned for inclusion in the work. Submit sample in specified finish.
- .5 LEED Submittals: Submit manufacturer's certification of the following items which contribute to LEED Certification:

**1.04 CLOSEOUT SUBMITTALS**

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

**1.05 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management, and with the Waste Reduction Workplan. Remove from site and dispose of all packaging materials at appropriate recycling facilities. Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

**1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name and address. Store materials off ground indoors in dry location and in accordance with

manufacturer's recommendations in clean, dry, well-ventilated area. Store and protect access doors from nicks, scratches, and blemishes.

- .3 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue. Leave protective covering in place until final cleaning of building.

## Part 2 Products

### 2.01 ACCESS DOORS

- .1 Recessed Access Door. Designed for flush installation in gypsum board and plaster wall assemblies while providing an invisible architectural appearance. Provide Access Door with factory installed layer of 16 mm GWB.
  - .1 Material: mill finish aluminum.
    - .1 Mounting frame: recessed aluminum angle extrusion.
    - .2 Door: recessed aluminum angle extrusion. Fitted with layer of 16 mm GWB. Door panel: removable.
  - .2 Latch: Flush to surface of gypsum board panel. Cylinder lock and key operated cam latch. Provide 2 latch points on doors over 300 x 300 mm. Optional latch: concealed touch latch mechanism for non-secure installations and where indicated.
  - .3 Hinge: concealed, non-corroding, two point pin hinge assembly.
  - .4 Gasketing: provide optional neoprene gasket around perimeter of door.
  - .5 Sizes: refer to drawings for locations and sizes of all Architectural Access doors. Refer to drawings and schedule for type of latch mechanism for each location.
- .2 Flush Access Door. Designed for flush installation in gypsum board and plaster wall assemblies with exposed flanges. Non-Fire Rated. General Purpose Access Door. Fabricate door to fit flush to frame.
  - .1 Material: cold rolled sheet steel.
    - .1 Frame: manufacturer's standard width exposed flange. Width of exposed flange proportional to door size. Minimum 1.63 mm (16 gauge) sheet steel.
    - .2 Door: minimum 1.63 mm (16 gauge) sheet steel with 90 degree, 9.5 mm fold on all four sides for structural rigidity.
  - .2 Latch: flush to door surface. manufacturers standard screwdriver operated cam mechanism. Quantity varies with size of door
  - .3 Hinge: concealed, non corroding two point pin hinge.
  - .4 Gasketing: provide optional neoprene gasket around perimeter of door.
  - .5 Sizes: refer to drawings for locations and sizes of all Architectural Access doors. Refer to drawings and schedule for type of latch mechanism for each location.
  - .6 Finish: electrostatically applied, rust inhibitive, white powder coat primer.
- .3 Stainless Steel Door: designed for flush installation in gypsum board and plaster wall assemblies with concealed flanges. Non-Fire Rated. General Purpose Access Door. Fabricate door to fit flush to frame.
  - .1 Material: Type No. 304 stainless steel sheet.
    - .1 Frame: manufacturer's standard width concealed flange. 1.63 mm (16 gauge) cold rolled sheet steel with 6 mm mounting holes.
    - .2 Door: minimum 1.63 mm (16 gauge) stainless steel sheet with 90 degree, 9.5 mm fold on all four sides for structural rigidity.

- .2 Latch: flush to door surface. Manufacturers standard screwdriver operated cam mechanism. Quantity varies with size of door.
- .3 Hinges: continuous stainless steel piano hinges.
- .4 Gasketing: provide optional neoprene gasket around perimeter of door.
- .5 Sizes: refer to drawings for locations and sizes of all Architectural Access doors. Refer to drawings and schedule for type of latch mechanism for each location.
- .6 Finish: No. 4 brushed finish. Remove tool and die marks and stretch lines, or blend into finish.
- .4 Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to Architectural access door and frame assemblies tested for fire test response characteristics according to the following test method and that are listed and labeled by ULC or Interek - Warnock Hersey:
  - .1 NFPA 252 or UL 10B for fire rated access door assemblies installed vertically.
  - .2 NFPA 288 for fire rated access door assemblies installed horizontally.

### **Part 3 Execution**

#### **3.01 EXAMINATION**

- .1 Verify existing conditions before starting work. Verify that rough openings for door and frame are correctly sized and located. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- .1 Install units to manufacturer written instructions. Install frames plumb and level in opening. Secure rigidly in place.
- .2 Stud framing. Provide additional steel stud framing all 4 sides for support of Access doors. Minimum distance between access door frame and stud: 35 mm. Maximum distance 75 mm.
- .3 Install doors flush with adjacent finish surfaces or recessed to receive finish material.
- .4 Location: as indicated in the drawings.
- .5 Position unit to provide convenient access to concealed work requiring access.
- .6 Adjust doors and hardware after installation, for proper operation.
- .7 Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

#### **3.03 CLEANING**

- .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

#### **3.04 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by access door installation.

**END OF SECTION**

**Part 1 General**

**1.01 SUMMARY**

- .1 Design, fabrication and installation of complete exterior curtain wall assembly. Vertical, glazed, prefinished curtain wall systems including tubular extruded aluminum self supporting sections. Shop fabricated, factory prefinished. Structural anchorage and attachments to building structure. Door adaptors for aluminum entrance door systems.
- .2 Assembled system to permit re-glazing of individual glass panels or individual aluminum wall panels from the exterior without requiring removal of structural mullion sections.
- .3 Include all accessories for completion of the curtain wall system. Include perimeter trims, stools, shims and anchors as well as perimeter sealing of curtain wall framing.
- .4 Perimeter System: Stick fabricated system with screw spline or shear block connections. Captured system. Thermally improved system with interior tubular section isolated from exterior pressure plate. 25 mm double glazed insulating glass panels. Framing: 63.5 x 152.4 mm nominal dimensions. Outside glazed pressure plate format. Fiberglass pressure plate with snap on aluminum cap. System to accept installation of formed aluminum wall panels as specified in Section 07 42 20 - Formed Metal Wall Panels.
- .5 Field System: Stick fabricated system with screw spline or shear block connections, 2 way, 4 sided Structural Silicone Glazed system. Thermally improved system with interior tubular section isolated from exterior glazing. 25 mm double glazed insulating glass. Framing 63.5 x 152.4 mm nominal dimensions. Outside glazed structural silicone glazed (SSG) format. System to accept installation of formed aluminum wall panels as specified in Section 07 42 20 - Formed Metal Wall Panels.
- .6 Mullion extension caps: custom sized exterior extended mullion cap fin. 63.5 mm x custom depth exterior cap.

**1.02 RELATED SECTIONS**

- .1 Section 07 42 20 - Formed Metal Wall Panels.
- .2 Section 07 84 00 - Comprehensive Firestopping.
- .3 Section 07 92 10 - Joint Sealants.
- .4 Section 08 11 16 - Aluminum Doors and Frames.
- .5 Section 08 81 00 - Glass Glazing.

**1.03 REFERENCES**

- .1 American Architectural Manufacturers Association (AAMA).
  - .1 AAMA CW-DG-1-96(2005). Aluminum Curtain Wall Design Guide Manual.
  - .2 AAMA CW-10-15. Care and Handling of Architectural Aluminum From Shop to Site.
  - .3 AAMA CW-11-85. Design Wind Loads for Buildings and Boundary Layer Wind Tunnel Testing.
  - .4 AAMA CWG-1-89. Installation of Aluminum Curtain Walls.
  - .5 AAMA 501-15. Methods of Test for Exterior Walls.
  - .6 AAMA 501.1-05. Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.

- .7 AAMA 501.4-09. Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts.
- .8 AAMA 501.5-07. Test Method for Thermal Cycling of Exterior Walls.
- .9 AAMA 503-14. Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.
- .10 AAMA 1503-09. Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
- .11 AAMA 2605-13. Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- .2 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A276/A276M-16a. Standard Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B209-14. Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - .3 ASTM B221-14. Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - .4 ASTM B456-11e1. Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - .5 ASTM B633-15. Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
  - .6 ASTM C864-05(2015). Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
  - .7 ASTM D523-14. Standard Test Method for Specular Gloss.
  - .8 ASTM D638-14. Standard Test Method for Tensile Properties of Plastics.
  - .9 ASTM D695-15. Standard Test Method for Compressive Properties of Rigid Plastics.
  - .10 ASTM D790-15e2. Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .11 ASTM D953-10. Standard Test Method for Bearing Strength of Plastics.
  - .12 ASTM D968-15. Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
  - .13 ASTM D2247-15. Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity.
  - .14 ASTM D3363-05(2011)e2. Standard Test Method for Film Hardness by Pencil Test.
  - .15 ASTM D3846-08(2015). Standard Test Method for In-Plane Shear Strength of Reinforced Plastics.
  - .16 ASTM D4585/D4585M-13. Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation.
  - .17 ASTM D7091-13. Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
  - .18 ASTM E90-09. Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .19 ASTM E283-04(2012). Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - .20 ASTM E330/E330M-14. Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

- .21 ASTM E331-00(2016). Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- .22 ASTM E783-02(2010). Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
- .23 ASTM E1105-15. Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
- .24 ASTM E1300-12ae1. Standard Practice for Determining Load Resistance of Glass in Buildings.
- .25 ASTM E1425-14. Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems.
- .26 ASTM E2692-10. Standard Test Method for Structural Performance of Thermal Barriers in Fenestration Products.
- .27 ASTM G85-11. Standard Practice for Modified Salt Spray (Fog) Testing.
- .3 Canadian Standards Association (CSA International).
  - .1 CAN/CSA-S157-05(R2015). Strength Design in Aluminum.
  - .2 CSA W59.2-M1991(R2013). Welded Aluminum Construction.

#### **1.04 PERFORMANCE REQUIREMENTS**

- .1 Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified Professional Engineer, registered to practice in Ontario to meet the following performance requirements and design criteria.
- .2 Design and test system in accordance with AAMA 501.
- .3 Design aluminum components in accordance with CAN/CSA-S157.
- .4 Design glass thickness and glass unit dimensions to limits established in ASTM E1300.
- .5 Design system as a thermally broken, pressure equalized vented and drained assembly. Design system to accept matching aluminum entrance systems.
- .6 Design system to accommodate, without damage to components or deterioration of seals:
  - .1 Movement within system.
  - .2 Movement between system and perimeter framing components.
  - .3 Dynamic loading and release of loads.
  - .4 Movements of supporting structure including story drift, twist and deflection from uniformly distributed and concentrated live load.
  - .5 Deflection of structural support framing.
  - .6 Shortening of building structural columns.
  - .7 Long term creep of structural members.
  - .8 A mid-span slab edge deflection of 13 mm.
  - .9 Penetration of moisture with rainscreen design for discharge and drainage.
  - .10 Thermal stresses transferring to building structure.
  - .11 Loosening or weakening of fasteners, attachments, and other components.
  - .12 Failure of operating units.
- .7 Design and size components to withstand dead and live loads caused by loads acting normal to plane of system as calculated in accordance with NBC. Design pressure of 40 psi (1915 Pa) as measured in accordance with AAMA CW-11 and ASTM E330.

- .8 Structural Loads:
  - .1 Uniform Wind Load: to ASTM E330. Static air design load of 957.5 Pa (20 psf) applied in positive and negative direction; no deflection in excess of  $L/175$  of span of any framing member at design load.
  - .2 Design and size the system including anchorage to withstand structural forces placed upon it without failure, damage, distress or permanent deformation when tested in accordance with ASTM E330 using load 1.5 times the design wind loads and of 10 seconds in duration.
  - .3 Member deflection: limit deflection of the edge of the glass normal to the plane of the glass to  $1/175$  of the glass edge length or 19 mm, whichever is less.
  - .4 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with NBC. Design system to meet design displacement of  $0.010 \times$  the story height and ultimate displacement of  $0.015 \times$  the design displacement when tested to AAMA 501.4.
- .9 Deflection of Framing Members at design wind pressure as follows:
  - .1 Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding  $L/175$  of the glass edge length for each individual glazing lite, or an amount that restricts edge deflection of individual glazing lites to 19 mm whichever is less. Limit deflection of clear span of framing members to  $L/175$  for spans less than or equal to 4.11 meters and  $L/240 + 6$  mm for spans greater than 4.11 meters.
  - .2 Deflection Parallel to Glazing Plane: Limited to  $L/360$  of clear span or 3.2 mm, whichever is less.
  - .3 Cantilever Deflection: where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.
- .10 Seismic Story Drift: accommodate design displacement of adjacent stories indicated.
  - .1 Design Displacement: shall not exceed 1% of story height.
  - .2 Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.
- .11 Sound Transmission Loss: minimum Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) when tested to ASTM E90 and ASTM E1425:
  - .1 STC 31 or OITC 25 based upon 25 mm thick glass panel, consisting of 6 mm, 12 mm air space and 6 mm.
- .12 Water penetration (static): no evidence of water penetration when measured through fixed glazing and framing areas with a pressure of 15.0 PSF (720 Pa) when tested in accordance with AAMA 501, ASTM E331 and ASTM E1105.
- .13 Water penetration (dynamic): no evidence of water penetration through fixed glazing and framing areas, with a pressure of 15.0 PSF (720 Pa) when measured in accordance with AAMA 501.1.
  - .1 Maximum water leakage: no uncontrolled water penetrating assemblies or water appearing on assemblies normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
- .14 Energy Performance: test glazed aluminum curtain walls in accordance with AAMA 1503.

- .1 Perimeter System. Thermal Transmittance (U-factor): glass and framing areas shall have U-factor of no greater than 0.33 with 25.4 mm thick High Performance (HP) Glass panels according to AAMA 1503.
- .2 Air infiltration: maximum air leakage through fixed glazing and framing areas of 0.06 cfm per square foot (0.31 litres per second per square metre of fixed wall area as determined according to ASTM E283 at a minimum static air pressure differential of 6.24 psf (300 Pa).
- .3 Condensation resistance: when tested to AAMA 1503, the condensation resistance factor shall not be less than:
  - .1 Perimeter System with fiberglass pressure plate: CRF glass (25 mm double glazed): 68. CRF frame: 76.
- .15 Thermal movement: allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
  - .1 Temperature change: -18 degrees C) to 82 degrees C.
  - .2 Test interior ambient air temperature: 24 degrees C.
  - .3 Test performance: no buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5 for a minimum 3 cycles.
- .16 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- .17 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

#### 1.05 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets.
- .3 Submit manufacturer's product data sheets. Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details and water flow diagrams.
- .4 Submit shop drawings:
  - .1 Submit shop drawings stamped by Professional Engineer licensed to practice in the Province of Ontario.
  - .2 Indicate each type of curtain wall including locations. Provide full size, scaled elevations for each location. Indicate materials, core thicknesses, sizes and profiles for all components. Indicate interior trim and exterior junctions with adjacent construction. Indicate junctions between combination units.
  - .3 Indicate: type and location of exposed finishes, method of anchorage, anchor details and number of anchors, supports, reinforcement and accessories. Indicate location of caulking. Indicate arrangement of hardware.
  - .4 Indicate system dimensions, framed opening requirements and tolerances, clearance to adjacent construction, anticipated deflection under load, affected related Work, expansion and contraction joint location and details.
  - .5 Indicate design requirements for glazing including: thickness, attachment, deflection, seismic, wind, and thermal movement. Provide glass design stamped by Professional Engineer licensed to practice in the Province of Ontario.



- .6 Framing members: provide structural and physical characteristics, calculations, dimensional limitations and special installation requirements.
- .7 Indicate assembly details and dimensions of fabrication.
- .5 Indicate installation details and sequencing. Indicate method of glass installation. Indicate location and method of sealing glass to curtain wall frame components.
- .6 Submit samples:
  - .1 Submit duplicate samples illustrating prefinished aluminum surface, colours, texture and finish. Submit 300 mm long pieces.
  - .2 Submit 300 x 300 mm samples of glass units, infill panels, glazing materials.
  - .3 Submit samples of glass in full range of available products.
- .7 Submit design data. Provide framing member structural and physical characteristics, calculations, dimensional limitations and special installation requirements. Design structural support framing components to CAN/CSA-S157 under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the Province of Ontario.
- .8 Submit test reports from approved independent testing laboratories along with substantiating engineering data, certifying compliance with specifications for:
  - .1 Structural design.
  - .2 Wind load resistance.
  - .3 Air infiltration.
  - .4 Water penetration.
  - .5 Condensation resistance.
  - .6 Finishes.
- .9 Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and supportive data.
- .10 Provide documentation in accordance with Section 01 35 21 - LEED Requirements.

#### **1.06 MAINTENANCE DATA**

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

#### **1.07 QUALITY ASSURANCE**

- .1 Manufacturer: company specializing in manufacturing the products specified in this section with minimum 15 years documented experience.
- .2 Obtain aluminum curtain wall system through one source from a single manufacturer.
- .3 Installer qualifications: company specializing in performing the work of this section with minimum 10 years documented experience. Approved by manufacturer.
- .4 Construct Mock-Up in accordance with Section 01 45 00 - Quality Control.
- .5 Construct Mock Up panel minimum 1800 mm wide from floor to floor. Include: intermediate mullion, corner mullion, sill, glass panels. Assemble to illustrate component assembly including glazing materials, attachments, anchors, and perimeter sealant. Mock-up to include junction of curtain wall and other construction. Mock up to include installation of aluminum panels.
- .6 Locate where directed by Consultant. Allow 72 hours for inspection of Mock-Up by Consultant before proceeding with work.

- .7 When accepted, Mock-Up will demonstrate minimum standard for this work. If approved, Mock-Up may remain as part of finished work.

**1.08 PRE-INSTALLATION MEETING**

- .1 Conduct pre-installation meeting one month prior to commencing work of this section and on-site installations. Meeting is to verify project requirements, co-ordinate with other building subtrades, establish condition and completeness of curtain wall openings, manufacturer's installation instructions and manufacturer's warranty requirements.
- .2 Field Measurements: verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

**1.09 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements and Manufacturer's printed instructions.
- .2 Cover all exposed prefinished surfaces with pressure sensitive heavy protection paper, before shipping to job site. Do not use adhesive papers or sprayed coatings, which bond when exposed to sunlight or weather.
- .3 Deliver store and handle materials in accordance with manufacturer's written instructions. Handle work of this section in accordance with AAMA CW-10.
- .4 Store all materials indoors in dry location. Ensure materials do not come in contact with ground or other damp substrates.
- .5 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

**1.010 ENVIRONMENTAL REQUIREMENTS**

- .1 Maintain air temperature and structural base temperature at installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

**1.011 SEQUENCING**

- .1 Coordinate work of this section with installation of fire stopping, flashing placement, and related components or materials.

**1.012 WARRANTY**

- .1 For the Work of this Section, the 12 months warranty period prescribed in the General Conditions is extended to 24 months.

**1.013 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Aluminum extrusions: to ASTM B221 and aluminum association alloy AA6063-T6 alloy and temper. Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish. Minimum wall thickness of 1.8 mm at any location for the main frame.
- .2 Sheet aluminum: to ASTM B209. Form aluminum components from sheet aluminum stock, of alloy and temper to suit their purpose and finish requirements.
- .3 Panels: aluminum panels as specified in Section 07 42 20 - Formed Metal Wall Panels.
- .4 Reinforcing members: aluminum, nonmagnetic stainless steel, or nickel/chrome plated steel meeting ASTM B456 for Type SC 3 severe service conditions, or zinc coated steel or iron meeting ASTM B633 for SC 3 severe service conditions or other suitable zinc coating. Provide sufficient strength to withstand design pressure indicated. Roll formed to suit mullion sections.
  - .1 Brackets and reinforcing: manufacturer's standard high strength aluminum with non staining, nonferrous shims for aligning system components.
- .5 Anchors, clips, and accessories: aluminum, nonmagnetic stainless steel, or zinc coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating. Provide sufficient strength to withstand design pressure indicated.
- .6 Fasteners: non magnetic stainless steel, to ASTM A276, 300 series or 400 series. Aluminum or cadmium plated steel of sufficient size and quantity to suit their intended purpose. Materials to be non corrosive and compatible with aluminum members, trim hardware, anchors, and other components.
- .7 Firestopping: as specified in Section 07 84 00 - Firestopping.
- .8 Sealant: as specified in Section 07 92 10 - Joint Sealants.
  - .1 For sealants required within fabricated curtain wall system, provide permanently elastic, non shrinking, and non migrating type recommended by sealant manufacturer for joint size and movement.
  - .2 Structural Silicone Sealant: SSG components approved by Curtain Wall system Manufacturer. Capable of withstanding tensile and shear stresses imposed by structural sealant glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
    - .1 Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
    - .2 Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
- .9 Thermal breaks: engineered rigid polymer. 25.4 mm separation between the interior and exterior metal members. Thermal barrier assembly tested to the thermal cycling requirements of ASTM E2692 and show no sign of degradation following the test.
- .10 Pressure plate: fiberglass plate tested to ASTM D638, ASTM D790, ASTM D695, ASTM D953 and ASTM D3846. Fastened to the mullion with stainless steel screws. Pressure plate of sufficient size and strength to provide adequate bite on glass panels.
- .11 Pressure plate cover: snap on cover from extruded aluminum, manufacturers standard sizes and profiles as detailed and to suit job conditions.

- .12 Mullion extension caps: extruded aluminum, custom sized exterior extended mullion cap fin. 63.5 mm x custom depth exterior cap.
- .13 Door adapters: extruded aluminum, prefinished to match curtain wall framing. Manufacturers standard profiles to allow installation of aluminum doors as specified in Section 08 11 16 - Aluminum Doors and Frames.
- .14 Sills, flashings and trim: brake formed, prefinished aluminum sheet. Minimum 1.6 mm thick. Size and profile as detailed and to suit job conditions. Complete with joint covers and concealed fasteners and anchoring devices. Finish to match curtain wall mullion sections.
- .15 Drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system. Internal mullion baffles to eliminate "stack effect" air movement within internal spaces.
- .16 Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.
- .17 Glazing materials:
  - .1 Glazing gaskets: to ASTM C864. Extruded, black, closed cell or dense elastomer.
  - .2 Glazing tapes: macro-polyisobutylene, highly adhesive and elastic, complete with built-in shim.
  - .3 Spacers and setting blocks: manufacturer's standard elastomeric type.
  - .4 Bond breaker tape: manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
  - .5 Glazing sealants: as recommended by manufacturer for joint type.
- .18 Glass: 25 mm thick, double glazed, hermetically sealed panels. Glass Types as specified in Section 08 81 00 - Glass Glazing.
  - .1 Ground Floor:
    - .1 Where glass panels are located within 850 mm of the floor level at the interior: **Type GV:** Tempered both interior and exterior pane.
    - .2 Remainder of glass panels at ground floor: **Type GV:** Tempered exterior pane.
  - .2 Second Floor: **Type GV:** Tempered exterior pane.
  - .3 Third and Fourth Floor: **Type GV.**
  - .4 Spandrel panels: **Type GS.**
  - .5 Exterior doors, frame and screens installed into the curtain wall system: 25 mm thick, double glazed hermetically sealed panels as specified in Section 08 11 16 - Aluminum Doors and Frames.

## 2.02 FABRICATION

- .1 Fabricate in accordance with manufacturers written instructions.
- .2 Perform work in accordance with AAMA CWG-1. Maintain one copy on site.
- .3 Design and fabricate to eliminate any seams or joints in vertical members.
- .4 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly without adversely affecting the installation and dynamic movement of perimeter seal.
- .5 Prepare and install components to receive anchor devices.
- .6 Perform welding work in accordance with CSA W59.2.

- .7 All framing joints to be accurately machined, fit, assembled, secured and sealed to provide tight, hairline, flush, neat weathertight joints and corners.
- .8 Arrange fasteners and attachments to ensure concealment from view.
- .9 Prepare system to accept installation of formed sheet aluminum panels as specified in Section 07 42 20 - Formed Metal Wall Panels.
- .10 Prepare system components to receive doors and hardware as specified in Section 08 11 16 - Aluminum Doors and Frames.
- .11 Reinforce framing members for external imposed loads.
- .12 Visible manufacturer's identification labels not permitted.
- .13 Form or extrude aluminum shapes before finishing.
- .14 Fabricate components for assembly using shear block system following manufacturer's standard installation instructions.
- .15 Fabricate components that, when assembled, have the following characteristics:
  - .1 Profiles are sharp, straight, and free of defects or deformations.
  - .2 Accurately fitted joints.
  - .3 Physical and thermal isolation of glazing from framing members.
  - .4 Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - .5 Provisions for field replacement of glazing from exterior.
  - .6 Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
  - .7 Internal weeping system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
  - .8 Double seal design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
  - .9 After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.03 ALUMINUM FINISHES

- .1 Painted finish meeting AAMA 2605. Properties as follows:
  - .1 Dry film thickness: to ASTM D7091. 1.2 mil.
  - .2 Pretreatment: multi stage cleaning with chrome phosphate conversion coating at 40 mg per square foot minimum.
  - .3 Dry film hardness: to ASTM D3363. F minimum.
  - .4 Impact resistance: 1/10 inch deformation. No loss of adhesion.
  - .5 Abrasion resistance: to ASTM D968. Coefficient of 40 minimum.
  - .6 Color retention: 10 years south Florida. Maximum 5 delta E.
  - .7 Gloss retention: minimum 50 % after 5 years south Florida.
  - .8 Corrosion resistance: 4000 hours. Humidity / salt spray.
  - .9 Salt spray: to ASTM G85. 2000 hours. Annex A5: Scribe or cut edges: Rating 7. Field rating 8.
  - .10 Humidity resistance: to ASTM D2247 or ASTM D4585. 4000 Hours. Few number 8 Blisters Maximum.

- .11 10 % muriatic acid spot rest. 15 minutes. No blistering or visual change.
- .12 Mortar (alkali) resistance: 24 hour spot test. No visual change.
- .13 72 hour detergent immersion at 100 degrees F: No loss of adhesion.
- .14 Boiling water adhesion: no removal of film after 20 min. exposure.
- .15 Chalking resistance: no more than number 8. Number 6 for whites.
- .16 Erosion resistance: less than 10 % after 10 years south Florida.
- .17 PVDF content: minimum 70 % by volume weight into the paint system. Kynar 500 or Hylar 5000 resins plus durable ceramic pigments.
- .18 Colour: White. Selected by Consultant from full and extended range of available colours.
- .19 Gloss: to ASTM D523. Low and Medium. Gloss level will be selected by Consultant.
- .2 Pretreatment. Thoroughly clean using a multi stage cleaning process to remove organic and organic surface soils and residual oxides.
- .3 Apply a chemical conversion coating to which organic coatings will firmly adhere.
- .4 Factory apply primer to a thickness of 0.2 - 0.3 mils.
- .5 Factory apply paint and oven bake for a topcoat film thickness of 1.0 mil minimum.

### **Part 3 Execution**

#### **3.01 EXAMINATION**

- .1 Verify dimensions, tolerances, and method of attachment with other work.
- .2 Verify wall openings and adjoining surfaces are prepared and ready to receive work of this section and match reviewed Shop Drawings.
- .3 Examine areas for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- .4 Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- .1 Install curtain wall system in accordance with manufacturer's written instructions and reviewed Shop Drawings.
- .2 Do not install damaged components.
- .3 Install curtain wall systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions. Provide support and anchor in place.
- .4 Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- .5 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Rigidly secure non movement joints.
- .6 Provide alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.
- .7 Align assembly and install plumb, level and square, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .8 Fit joints to produce hairline joints free of burrs and distortion.

- .9 Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- .10 Provide thermal isolation where components penetrate or disrupt building insulation.
- .11 Install sill flashings.
- .12 Coordinate installation of fire stop insulation, specified in Section 07 84 00 - Comprehensive Firestopping at each floor slab edge and intersection with vertical construction where indicated. Install fire-proofing in areas as indicated.
- .13 Pack fibrous insulation in shim spaces at perimeter of assembly. Apply spray foam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .14 Install door adapters and related components to accept framing system as specified in Section 08 11 16 - Aluminum Doors and Frames.
- .15 Install glass panels in accordance with Section 08 81 00 - Glass Glazing, to glazing method required to achieve performance criteria. Exterior wet/dry method of glazing. Place sealant on the up-slope side of the pressure plate cover caps. Finish the surface with a slope to encourage drainage over the cap. Cover caps to conceal screws and provide continuous sightline.
- .16 Install perimeter sealant to method required to achieve performance criteria in accordance with Section 07 92 10 - Joint Sealants. Seal joints watertight unless otherwise indicated.
- .17 Install formed aluminum wall panels into curtain wall framing as specified in Section 07 Section 07 42 20 - Formed Metal Wall Panels to methods required to achieve specified performance criteria.
- .18 Metal Protection:
  - .1 Where aluminum will contact dissimilar metals, protect against galvanic action by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
  - .2 Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- .19 Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

### 3.03 SITE TOLERANCES

- .1 Maximum variation from plumb: 1.5 mm/m non-cumulative or 10 mm / 30 m, whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.
- .3 Maximum sealant space between curtain wall and adjacent construction: 13 mm.

### 3.04 FIELD QUALITY CONTROL

- .1 Field Tests: test units as selected by consultant as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected.
- .2 Perform testing in accordance with AAMA 503 by a qualified independent testing agency. Consultant will pay for testing and testing requirements.
  - .1 Air infiltration tests: conduct tests in accordance with ASTM E783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cubic feet per meter per square feet which ever is greater.



- .2 Water infiltration tests: conduct tests in accordance with ASTM E1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 pounds per square foot (383 Pa).

### 3.05 MANUFACTURER'S FIELD SERVICES

- .1 Curtain wall manufacturer to provide field surveillance of installation of their Products.
- .2 Monitor and report installation procedures, unacceptable conditions. Inspection will monitor quality of installation and glazing.

### 3.06 CLEANING

- .1 Remove protective material from prefinished aluminum surfaces. Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .2 Take care to prevent the use of procedures and chemicals that could damage the finishes on the curtain wall or on the building itself.
- .3 Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions.
- .4 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- .5 Clean aluminum with a damp rag and an approved non-abrasive cleaner.
- .6 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.
- .7 Clean glass and glazing materials with an approved non-abrasive cleaner.
- .8 Replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- .9 Remove construction debris from project site and legally dispose of debris.

### 3.07 PROTECTION

- .1 Protect finished Work from damage.
- .2 Protect finished surfaces from damage during construction. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

**END OF SECTION**



## 1 General

### 1.1 SECTION INCLUDES

- 1.1.1 Comply with Division 1 General and Supplementary Conditions, related drawings and general requirements of contract.
- 1.1.2 The work in this section includes furnishing of all commercial finishing hardware as hereinafter specified or obviously necessary for all openings, except items which are specifically excluded from this section.

### 1.2 RELATED REQUIREMENTS

- 1.2.1 Specifications throughout entirety of Divisions for the project are directly applicable to this Section, and this Section is directly applicable to them.

### 1.3 RELATED SECTIONS

- 1.3.1 Section 06 10 00 – Rough Carpentry, Blocking for Hardware
- 1.3.2 Section 06 20 00 – Finish Carpentry
- 1.3.3 Section 08 06 11 – Door Schedule
- 1.3.4 Section 08 11 13 – Steel Doors and Frames
- 1.3.5 Section 08 11 16 – Aluminum Doors and Hardware
- 1.3.6 Section 26 00 00 – Electrical
- 1.3.7 Section 28 00 00 – Electronic Safety and Security

### 1.4 REFERENCE STANDARDS

- 1.4.1 American National Standards Institute ([ANSI](#))/Builders Hardware Manufacturers Association ([BHMA](#)):

- 1.4.1.1 ANSI/BHMA A156.1, Butts and Hinges
  - 1.4.1.2 ANSI/BHMA A156.3, Exit Device
  - 1.4.1.3 ANSI/BHMA A156.4, Door Controls / Door Closers
  - 1.4.1.4 ANSI/BHMA A156.5, Auxiliary Locks and Associated Products
  - 1.4.1.5 ANSI/BHMA A156.6, Door Trims
  - 1.4.1.6 ANSI/BHMA A156.8, Door Controls / Overhead Holders
  - 1.4.1.7 ANSI/BHMA A156.13, Mortise Locks & Latches
  - 1.4.1.8 ANSI/BHMA A156.15, Closer / Holder / Release Devices
  - 1.4.1.9 ANSI/BHMA A156.26, Continuous Hinges
  - 1.4.1.10 ANSI/ICC A117.1-2009, Standard for Accessible and Usable Buildings and Facilities
  - 1.4.1.11 ANSI/BHMA A156 Standards Set
  - 1.4.1.12 ANSI/BHMA A156.10-2005, Power Operated Pedestrian Doors
  - 1.4.1.13 ANSI/BHMA A156.18-2006, Materials and Finishes
  - 1.4.1.14 ANSI/BHMA A156.19-2007, Power Assist and Low Energy Power Operated Doors
  - 1.4.1.15 Builders Hardware Manufacturers Association ([BHMA](#)):  
Directory of Certified Products
  - 1.4.1.16 Door and Hardware Institute ([DHI](#)):
-

Sequence and Format for the Hardware Schedule

- 1.4.1.17 ANSI/DHI A115.IG Installation Guide for Doors and Hardware
- 1.4.1.18 UL 437-2000, Key Locks
- 1.4.1.19 Warnock Hersey – Intertek (WH):
- 1.4.1.20 Underwriters Laboratories of Canada (ULC):
- 1.4.1.21 NFPA 80 – Fire Doors and Windows
- 1.4.1.22 NFPA 101 – Life Safety Code

1.5 SUBMITTALS

- 1.5.1 Provide required information in accordance with Division 1, General Requirements, Section 01 00 06 and Section 01 33 00 - Submittals
- 1.5.2 Action Submittals – Schedule and Product Data: Provide the following submittals before starting any work of this Section:
  - 1.5.2.1 Product Data: Submit product data (3 copies) indicating installation details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 1.5.2.2 Shop Drawings: Submit shop drawings (3 copies) indicating details of electrified door hardware including, but not limited to, the following:
    - 1.5.2.2.1 Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer installed and site installed wiring, and as follows:
      - Riser diagram
      - Elevation of each door
    - 1.5.2.2.2 Theory of operation for electrified hardware groups
  - 1.5.2.3 Templates: Upon receipt of the reviewed Hardware Schedule furnish a complete set of applicable templates, together with the approved hardware schedule, to the contractor. The contractor shall distribute to the related trades.
  - 1.5.2.4 Hardware Schedule: Submit (3 copies) door hardware schedule prepared by or under the supervision of qualified Architectural Hardware Consultant (AHC), detailing fabrication and assembly of door hardware.

1.6 PROJECT CLOSEOUT SUBMISSIONS

- 1.6.1 Operation and Maintenance Data: Provide two (2) sets of operations and maintenance information documents, in accordance with Section 01 78 23 – Operations and Maintenance Data, 01 00 06 – General Requirements: Operations and Maintenance Data.
    - 1.6.1.1 Approved Hardware Schedule, with architects stamp
    - 1.6.1.2 As-Built Final Hardware Schedule, with includes all approved change orders
    - 1.6.1.3 Catalogue Cut Sheets
    - 1.6.1.4 Hardware Installation and Maintenance Manuals
-

- 1.6.1.5 Warranty Letter
- 1.6.1.6 Elevation Drawings for electronic openings

## 1.7 QUALITY ASSURANCE

### 1.7.1 Regulatory Requirements:

- 1.7.1.1 Building Code Compliance: Conform to ULC and Building Code requirements, as applicable to hardware, for labelled or rated doors and frames, and for exiting, operation and function.
- 1.7.1.2 Manufacturing Compliance: Use only products listed in the BHMA Directory of Certified Products for hardware of this Project.

### 1.7.2 Qualifications: Provide proof of qualifications when requested by Consultant:

- 1.7.2.1 Recognized as an architectural hardware supplier, who has been furnishing architectural hardware for a minimum of (5) years to the construction industry.
- 1.7.2.2 Have in its employment at least one permanent staff member who is fully certified and is a licensed Architectural Hardware Consultant (AHC).
- 1.7.2.3 Completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, and who has the capability of preparing data for electrified door hardware, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- 1.7.2.4 Be available during the course of the project to consult with the Contractor, Consultant(s), and/or Owner(s) about door hardware and related section(s) requirements.

## 1.8 DELIVERY, STORAGE, AND HANDLING

### 1.8.1 Delivery and Acceptance Requirements: Deliver hardware items in original factory containers, clearly labelling contents and scheduled use for this project and as follows:

- 1.8.1.1 Inventory door hardware on receipt and contractor to provide a secure lock up for door hardware delivered to Project site.
  - 1.8.1.2 Store hardware in a clean, well illuminated (500 lux minimum) securely locked storage room accessible only to authorized personnel.
  - 1.8.1.3 Construction keys are to be hand delivered directly to the contractor / authorized personnel on site.
-

1.8.2 Storage and Handling Requirements: Store hardware items on shelves; not on floors, separated and packaged as a group for each individual door with the door number, and list of items for that door on each package related to the door hardware schedule, and include basic installation instructions with each item or package and as follows:

1.8.2.1 Maintain an itemized inventory list of each item, updated on a daily basis, to show items in storage and items installed.

## 1.9 WARRANTY

1.9.1 Provide written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1.9.2 Warranty against failure due to defective materials and/or workmanship for a minimum period of one (1) year, commencing on the date of final completion, turnover. In the event of failure, promptly repair and/or replace the item(s) at no cost to the owner (Product only, does not include any labour).

1.9.3 Warranty Period: From date of Substantial Performance, and as follows:

| Hardware Type                | Warranty Term |
|------------------------------|---------------|
| Hinges                       | 1 year        |
| Locks, latches and cylinders | 2 year        |
| Panics                       | 2 years       |
| Closers                      | 10 years      |
| Operators                    | 1 year        |
| Electronic Hardware          | 1 year        |
| Miscellaneous                | 1 year        |

## 2 Products

### 2.1 MANUFACTURERS

2.1.1 Hardware to be supplied per tendered Schedule of Finishing Hardware as prepared by Trillium Architectural Products.

2.1.2 Any request for alternates not listed must be made a minimum of seven (7) days prior to tender closing for review by project team.

2.1.3 Any request for alternate must include a complete package of product data for each substituted hardware item detailing conformance with applicable specified product listed in this specification section.

2.1.4 Any substituted product not submitted for review a minimum of seven (7) days prior to tender closing will not be reviewed and will be rejected.

2.1.5 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, as specified in Schedule of Finishing Hardware:

- 2.1.5.1 Mortise Hinges:
    - 2.1.5.1.1 Mckinney (ASSA Abloy DSS Canada)  
Specified: TA714, TA786  
Alternates: Ives, Stanley
  - 2.1.5.2 Continuous Hinges:
    - 2.1.5.2.1 Mckinney (ASSA Abloy DSS Canada)  
Specified: MCK-112HD  
Alternates: Hager, Ives, Pemko
  - 2.1.5.3 Flush Bolts:
    - 2.1.5.3.1 Rockwood (ASSA Abloy DSS Canada)  
Specified: 1848(automatic)  
Alternates: Gallery, Hager, Ives
  - 2.1.5.4 Mechanical Locks and Latches:
    - 2.1.5.4.1 Sargent (ASSA Abloy DSS Canada)  
Specified: 8200 series, LNJ - Lever Design  
Alternates: None
  - 2.1.5.5 Exit Devices:
    - 2.1.5.5.1 Sargent (ASSA Abloy DSS Canada)  
Specified: 8800 series J - Lever Design  
Alternates: None
  - 2.1.5.6 Cylinders:
    - 2.1.5.6.1 Sargent (ASSA Abloy DSS Canada)  
Specified: DG series  
Alternates: None
  - 2.1.5.7 Door Closers:
    - 2.1.5.7.1 Sargent (ASSA Abloy DSS Canada)  
Specified: 1430 & 350 series  
Alternates: None
  - 2.1.5.8 Auxiliary Trims:
    - 2.1.5.8.1 Gallery Specialty Hardware  
Specified: GSH-Custom, GS80A  
Alternates: None
  - 2.1.5.9 Overhead Stop Holder:
    - 2.1.5.9.1 Rixson (ASSA Abloy DSS Canada)  
Specified: 1,55 & 9 series  
Alternates: Glynn-Johnson, Sargent
  - 2.1.5.10 Auxiliary Stop:
    - 2.1.5.10.1 Gallery Specialty Hardware  
Specified: GSH209  
Alternates: CBH, Hager, Ives
-

- 2.1.5.11 Door Seals:
    - 2.1.5.11.1 K.N. Crowder Mfg.
    - Specified: W-13 / W-22 / W-24S / W-25 / W-42 / CT-10 / CT-72
    - Alternates: Hager, Pemko
  - 2.1.5.12 Key Cabinet:
    - 2.1.5.12.1 Lund
    - Specified: AWC 150S
    - Alternates: Telkee
  - 2.1.5.13 Automatic Door Operator:
    - 2.1.5.13.1 Hunter Automation
    - Specified: HA-8
    - Alternates: Besm, Dor-O-Matic
  - 2.1.5.14 Finish hardware supplier shall **Supply and Install** electro-mechanical swing door operator, consisting of electro-mechanical swinging door operator and electronic controller(s), aluminum operator header, connecting hardware, and power on/off switch and safety sensors as required, and as follows:
  - 2.1.5.15 Automatic entrance equipment: comply with ANSI A156.10, A156.19 and be UL or ULc listed.
  - 2.1.5.16 Aluminium header extrusions: minimum nominal 4 mm wall thickness with finish anodized AA-M12-C22-A31 clear to match adjacent aluminum materials.
  - 2.1.5.17 Equipment must operate between -35°C and +55°C in all climate conditions.
  - 2.1.5.18 Operator: Electro-mechanical system installed in a header to resist dust, dirt and corrosion; entire operator shall be removable from the header as a unit.
  - 2.1.5.19 Bearings: Fully lubricated and sealed to minimize wear and friction.
  - 2.1.5.20 Operator shall open the door with a minimum of 1/8 HP motor through reduction gears, door arm, and linkage assembly, and as follows:
  - 2.1.5.21 Low energy operator, door opening time: not be less than 4 seconds.
  - 2.1.5.22 The drive train shall have a positive, constant engagement. The operator shall stop the door in the open position by electrically reducing the motor voltage and stalling against a 90° stop.
  - 2.1.5.23 Close the door by spring energy; controlled by employing the motor as a dynamic brake.
-

- 2.1.5.24 Door closing time shall not be less than 4.5 seconds.
- 2.1.5.25 Pre-load closing spring for positive closing action at a low material stress level for long spring life.
- 2.1.5.26 The operator shall function as a manual door closer in the direction of swing with or without electrical power.
- 2.1.5.27 The door forces and speeds generated during power opening, and manual opening in both directions of swing, and spring closing in both directions of swing shall conform to the requirements of ANSI A156.10 or A156.19.
- 2.1.5.28 Verify that no defects or errors are present in completed phases of the work that would result in poor application or installation, or cause latent defects of the automatic door equipment.
- 2.1.5.29 Installation and warranty adjustments shall be performed by authorized distributors' factory trained technician.

## 2.2 KEYING

- 2.2.1 All locks and cylinders are to be furnished as a factory registered keyed system. Sargent patented key control Degree DG1, complete with construction keying provisions.
- 2.2.2 Keys:
  - 2.2.2.1 Keys: Provide keys in accordance with the following:
  - 2.2.2.2 **Quantity:** In addition to the cut keys supplied with each lock, provide the following:
    - 2.2.2.2.1 Cylinder Change Keys: 2
    - 2.2.2.2.2 Grand / Master Keys: 20
    - 2.2.2.2.3 Construction Master Keys: 15

## 2.3 FINISHES

- 2.3.1 The designations used in the schedule and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 or traditional U.S./Canada finishes shown by certain manufactures for their products.
  - 2.3.2 Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacture's standards, but in no case less the specified by reference standards for the applicable units of hardware.
    - 630/C32D – Satin Stainless Steel (base material, stainless steel)
    - 652/C26D – Satin Chrome Plated (base material, steel)
    - 626/C26D – Satin Chrome Plated (base material, brass/bronze)
-

|                                |                                   |
|--------------------------------|-----------------------------------|
| 628/C28 – Satin Aluminum       | (base material, Steel/aluminum)   |
| 689/AL – Power Coated Aluminum | (base material, steel or plastic) |
| 689/AL - Anodized Aluminum     | (base material, aluminum)         |

### 3 Execution

#### 3.1 EXAMINATION

- 3.1.1 Examine doors and frames, with installer present, for compliance with requirements for installation tolerances, labelled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- 3.1.2 Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- 3.1.3 Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.1.4 Install each door hardware item in accordance with manufacturer's written instructions and any special notes as directed.
- 3.1.5 Coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way.
- 3.1.6 Do not install surface mounted items until finishes have been completed on substrates involved, and as follows:
  - 3.1.6.1 Set units level, plumb, and true to line and location.
  - 3.1.6.2 Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 3.1.6.3 Drill and countersink units that are not factory prepared for anchorage fasteners.
  - 3.1.6.4 Space fasteners and anchors according to industry standards.

#### 3.2 INSTALLATION

- 3.2.1 Mount hardware units at heights in the following applicable publications, except as specifically indicated or required to comply with governing regulations.
  - 3.2.2 "Recommended Locations for Builders Hardware for Standard Steel Doors & Frames" as published by the Door & Hardware Institute (DHI)
  - 3.2.3 Install each hardware item in compliance with the manufacturer's instructions and recommendations.
-



### 3.3 SITE QUALITY CONTROL

- 3.3.1 Verify each door leaf opens closes and latches properly. Inspect fire rated openings to ensure they are installed in compliance with NFPA 80 requirements. Test access control system and electrified hardware devices for proper operation, owner and/or contractor to sign off on verification of operation. Verify electric door release hardware properly upon activates fire alarm system, in coordination with Div.26/28
- 3.3.2 After installation, coordinate with the manufactures representative to perform a hardware installation inspection, by an AHC (or equivalent) who is a member of the Door & Hardware Institute (DHI). Provide to the contractor a written report with a copy sent to the consultant, certifying correctness, functionality, proper operation of the specific scheduled finishing hardware. Provide in the report, detailed opening numbers that are found to have deficiency.

### 3.4 ADJUSTING

- 3.4.1 Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and in accordance with referenced accessibility requirements:

### 3.5 CLEANING AND PROTECTION

- 3.5.1 Clean adjacent surfaces soiled by door hardware installation.
- 3.5.2 Clean operating items as necessary to restore proper function and finish.
- 3.5.3 Contractor to provide all hardware, as it is stored on the construction site in a covered and dry place.
- 3.5.4 Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

### 3.6 DOOR HARDWARE SCHEDULE

- 3.6.1 Hardware schedule follows...
-



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Project#: P000040680

**SCHEDULE OF FINISHING HARDWARE  
FOR  
TOMLINSON - NEW BUILDING  
OTTAWA, ONTARIO**

Project Consultant:

Chris Moon [cmoon@trilliumarchitectural.com](mailto:cmoon@trilliumarchitectural.com)

Hardware Detailer:

Steve McRae, AHC [SMcRae@trilliumarchitectural.com](mailto:SMcRae@trilliumarchitectural.com)

**Date:** 13-Jun-16

**Revised:** 21-Sep-16 Issued for Review  
05-Aug-16 Issued for Review  
03-Aug-16 Issued for Review  
25-Jul-16 Issued for Review

1 PAIR OF DOORS D100A VESTIBULE - EAST ENTRY LHR/RHR

2/1103mm x 2678mm x 45mm

FRAME TYPE: AGS-1 / FRAME DETAIL: SIDELITES

DOOR TYPE: ALD-1 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

**NOTE:**

LHR LEAF ONLY - MOTION AUTOMATED

|        |                              |                                    |
|--------|------------------------------|------------------------------------|
| 2 EACH | CONTINUOUS HINGE             | MCK12-HD 120 CLEAR                 |
| 2 SET  | DOOR PULL CUSTOM             | GSH113318 X 1828mm O.A.#5 BTB C32D |
| 1 EACH | AUTOMATIC OPERATOR           | HA-8-1 OUTSWING DUAL 96in CA       |
| 2 EACH | MOTION DETECTOR              | 10EAGLE                            |
| 1 EACH | SUPERSCAN PRESENCE<br>SENSOR | 10SSIII DMPS BLK                   |
| 1 EACH | INTERFACE RELAY              | CX-12 BLOW-OUT FEATURE             |
| 2 EACH | OVERHEAD STOP                | 1-536 630                          |
| 1 LOT  | PERIMETER SEAL               | PERIMETER SEAL BY FRAME SUPPLIER   |
| 1 EACH | TECHNICAL DRAWING            | SECURITY DOOR ELEVATION            |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

ENTRY

- By pull trim
- By motion detector(LHR leaf only), operator powers door open
- In the event of fire, alarm powers BOTH door open and hold until remote keyswitch resets

EXIT

- By pull trim
  - By motion detector, operator powers door open
  - Free egress at all times
-

1 PAIR OF DOORS D100B

VESTIBULE - WEST ENTRY

LHR/RHR

2/1103mm x 2678mm x 45mm

FRAME TYPE: AGS-2 / FRAME DETAIL: SIDELITES

DOOR TYPE: ALD-1 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

**NOTE:**

LHR LEAF ONLY - MOTION AUTOMATED

|        |                              |                                    |
|--------|------------------------------|------------------------------------|
| 2 EACH | CONTINUOUS HINGE             | MCK12-HD 120 CLEAR                 |
| 2 SET  | DOOR PULL CUSTOM             | GSH113318 X 1828mm O.A.#5 BTB C32D |
| 1 EACH | AUTOMATIC OPERATOR           | HA-8-1 OUTSWING DUAL 96in CA       |
| 2 EACH | MOTION DETECTOR              | 10EAGLE                            |
| 1 EACH | SUPERSCAN PRESENCE<br>SENSOR | 10SSIII DMPS BLK                   |
| 1 EACH | INTERFACE RELAY              | CX-12 BLOW-OUT FEATURE             |
| 2 EACH | OVERHEAD STOP                | 1-536 630                          |
| 1 LOT  | PERIMETER SEAL               | PERIMETER SEAL BY FRAME SUPPLIER   |
| 1 EACH | TECHNICAL DRAWING            | SECURITY DOOR ELEVATION            |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

## ENTRY

- By pull trim
- By motion detector(LHR leaf only), operator powers door open
- In the event of fire, alarm powers BOTH door open and hold until remote keyswitch resets

## EXIT

- By pull trim
  - By motion detector, operator powers door open
  - Free egress at all times
-

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 PAIR OF DOORS D101

EXTERIOR - EAST ENTRY

LHRA/RHR

2/1062mm x 2670mm x 45mm

FRAME TYPE: CWF-11

DOOR TYPE: ALD-2 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

**NOTE:**

LHR LEAF ONLY - MOTION AUTOMATED

|        |                           |                                                  |
|--------|---------------------------|--------------------------------------------------|
| 1 EACH | CONTINUOUS HINGE          | MCK12-HD 120 CLEAR                               |
| 1 EACH | CONTINUOUS HINGE          | MCK12-HD EL-CETP-PREP X 120in LHR CLEAR          |
| 1 EACH | POWER TRANSFER            | EL-CEPT                                          |
| 1 EACH | WIRING HARNESS            | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH | WIRING HARNESS            | QC-C012P 12IN HARNESS 8PIN/4PIN SINGLE CONNECTOR |
| 1 EACH | CARD READER               | BY OTHERS                                        |
| 1 EACH | EXIT DEVICE               | 43 AD8410G C32D                                  |
| 1 EACH | ELECTRONIC EXIT DEVICE    | 43 55 56 AD8410G X 113 LESS PULL L/C LHR C32D    |
| 1 EACH | MORTISE CYLINDER          | 21 DG1-41 CMK/GMK C26D                           |
| 2 EACH | DOOR PULL CUSTOM          | GSH113318 X 1828mm O.A.#4B C32D                  |
| 1 EACH | AUTOMATIC OPERATOR        | HA-8-1 OUTSWING DUAL 96in CA                     |
| 2 EACH | MOTION DETECTOR           | 10EAGLE                                          |
| 1 EACH | SUPERSCAN PRESENCE SENSOR | 10SSIII DMPS BLK                                 |
| 1 EACH | INTERFACE RELAY           | CX-12 BLOW-OUT FEATURE                           |
| 2 EACH | OVERHEAD STOP             | 1-536 630                                        |
| 1 LOT  | PERIMETER SEAL            | PERIMETER SEAL BY FRAME SUPPLIER                 |
| 2 EACH | DOOR SWEEP                | W24S X 48in AL                                   |
| 1 EACH | THRESHOLD                 | CT45 X 84in AL                                   |
| 1 EACH | TECHNICAL DRAWING         | SECURITY DOOR ELEVATION                          |
| 1 EACH | POWER SUPPLY              | BPS-24-1 1 AMP                                   |
| 1 EACH | REX/MOTION DETECTOR       | BY OTHERS                                        |
| 2 EACH | DOOR CONTACT              | 1078                                             |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

**ENTRY**

- By keyed trim
- By motion detector(LHR leaf only), latch retracts, operator powers door open
- By valid card, after hours, latch retract, activates outside motion detector, operator powers door open
- In the event of fire, alarm powers BOTH door open and hold until remote keyswitch resets

**EXIT**

- By exit device
- By motion detector, latch retracts, operator powers door open
- Free egress at all times

1 PAIR OF DOORS D102

EXTERIOR - WEST ENTRY

LHRA/RHR

2/1062mm x 2670mm x 45mm

FRAME TYPE: CWF-10

DOOR TYPE: ALD-2 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

**NOTE:**

LHR LEAF ONLY - MOTION AUTOMATED

|        |                           |                                                  |
|--------|---------------------------|--------------------------------------------------|
| 1 EACH | CONTINUOUS HINGE          | MCK12-HD 120 CLEAR                               |
| 1 EACH | CONTINUOUS HINGE          | MCK12-HD EL-CETP-PREP X 120in LHR CLEAR          |
| 1 EACH | POWER TRANSFER            | EL-CEPT                                          |
| 1 EACH | WIRING HARNESS            | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH | WIRING HARNESS            | QC-C012P 12IN HARNESS 8PIN/4PIN SINGLE CONNECTOR |
| 1 EACH | CARD READER               | BY OTHERS                                        |
| 1 EACH | EXIT DEVICE               | 43 AD8410G C32D                                  |
| 1 EACH | ELECTRONIC EXIT DEVICE    | 43 55 56 AD8410G X 113 LESS PULL L/C LHR C32D    |
| 1 EACH | MORTISE CYLINDER          | 21 DG1-41 CMK/GMK C26D                           |
| 2 EACH | DOOR PULL CUSTOM          | GSH113318 X 1828mm O.A.#4B C32D                  |
| 1 EACH | AUTOMATIC OPERATOR        | HA-8-1 OUTSWING DUAL 96in CA                     |
| 2 EACH | MOTION DETECTOR           | 10EAGLE                                          |
| 1 EACH | SUPERSCAN PRESENCE SENSOR | 10SSIII DMPS BLK                                 |
| 1 EACH | INTERFACE RELAY           | CX-12 BLOW-OUT FEATURE                           |
| 2 EACH | OVERHEAD STOP             | 1-536 630                                        |
| 1 LOT  | PERIMETER SEAL            | PERIMETER SEAL BY FRAME SUPPLIER                 |
| 2 EACH | DOOR SWEEP                | W24S X 48in AL                                   |
| 1 EACH | THRESHOLD                 | CT45 X 84in AL                                   |
| 1 EACH | TECHNICAL DRAWING         | SECURITY DOOR ELEVATION                          |
| 1 EACH | POWER SUPPLY              | BPS-24-1 1 AMP                                   |
| 1 EACH | REX/MOTION DETECTOR       | BY OTHERS                                        |
| 2 EACH | DOOR CONTACT              | 1078                                             |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

**ENTRY**

- By keyed trim
- By motion detector(LHR leaf only), latch retracts, operator powers door open
- By valid card, after hours, latch retract, activates outside motion detector, operator powers door open
- In the event of fire, alarm powers BOTH door open and hold until remote keyswitch resets

**EXIT**

- By exit device
- By motion detector, latch retracts, operator powers door open
- Free egress at all times

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 PAIR OF DOORS D104  
2/813mm x 2440mm x 45mm

I.T. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 2 EACH  | FLUSH BOLT            | GSH 401 C26D                                     |
| 1 EACH  | FLUSH BOLT EXTENSION  | 36in                                             |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

1 SGL DOOR D105A  
915mm x 2440mm x 45mm

MENS WASHROOM

RH

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

|                  |            |     |
|------------------|------------|-----|
| 1 SGL DOOR D105B | W.R. STALL | LHR |
|------------------|------------|-----|

813mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

|                  |            |     |
|------------------|------------|-----|
| 1 SGL DOOR D105C | W.R. STALL | LHR |
|------------------|------------|-----|

813mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

|                  |                 |    |
|------------------|-----------------|----|
| 1 SGL DOOR D106A | WOMENS WASHROOM | LH |
|------------------|-----------------|----|

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |



## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D106B  
813mm x 2440mm x 45mm

W.R. STALL

RHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

1 SGL DOOR D106C  
813mm x 2440mm x 45mm

W.R. STALL

RHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D107  
915mm x 2440mm x 45mm

UNIVERSAL WASHROOM

LH

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                              |                                   |
|---------|------------------------------|-----------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D                |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C32D                     |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D            |
| 1 EACH  | ELECTRIC STRIKE              | HES 4500C 630                     |
| 1 EACH  | AUTOMATIC OPERATOR           | HA-8-1 INSWING                    |
| 2 EACH  | PUSH BUTTON                  | CM-45-4 PUSH TO OPEN BF LOGO C32D |
| 1 EACH  | WASHROOM RELAY KIT           | CX-WC11                           |
| 1 EACH  | EMERGENCY ASSISTANCE<br>KIT  | CX-WEC10                          |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 36.5in TAPE C32D     |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                      |
| 18 FEET | DOOR GASKET                  | W21 BLACK                         |
| 1 EACH  | DOOR CONTACT                 | 1078                              |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

## ENTRY

- By keyed lever trim
- By push button, operator powers open
- Enter facility, push (Push To Lock) button, locks strike, outside indicator light turns on, outside button turns off
- In the event of emergency push emergency button, exterior indicator dome light turns on

## EXIT

- By lever trim
- By push button, unlocks strike, operator powers open
- System resets
- Free egress at all times

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D108

JANITORS ROOM

RH

711mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 26.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 PAIR OF DOORS D110

ELEC. / I.T. CLOSET

RHR ACTIVE

2/762mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                       |                                                     |
|---------|-----------------------|-----------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                              |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                             |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL<br>CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL<br>CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                           |
| 1 SET   | AUTO FLUSHBOLT        | 1848 W/BOTTOM FIRE BOLT C32D                        |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                                |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                              |
| 1 EACH  | CO-ORDINATOR          | 1700 BLACK PRIME                                    |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                        |
| 21 FEET | DOOR GASKET           | S88 BLACK                                           |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                             |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                    |
| 2 EACH  | DOOR CONTACT          | 1078                                                |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D111  
915mm x 2440mm x 45mm

MAIL ROOM

LHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 NRP C26D        |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 PS EN - SURFACE MOUNTED  |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR D112

EXIT CORRIDOR

RHR

1016mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                                                                   |                         |
|---------|-------------------------------------------------------------------|-------------------------|
| 4 EACH  | HINGES                                                            | TA786 5 X 4.5 NRP C26D  |
| 1 EACH  | EXIT DEVICE                                                       | 12-8888J LESS TRIM C32D |
| 1 EACH  | EXIT DEVICE TRIM                                                  | 715-8 ETJ C26D          |
| 1 EACH  | DOOR CLOSER                                                       | 351 P10 EN              |
| 1 EACH  | MAGNETIC HOLDER                                                   | 1560 EN                 |
|         | (MAGNETIC HOLDER, WIRED INTO FIRE ALARM, RELEASE UPON ACTIVATION) |                         |
| 20 FEET | DOOR GASKET                                                       | S88 BLACK               |

1 PAIR OF DOORS D113

COAT CLOSET

LHR/RHR

2/726mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |             |                        |
|---------|-------------|------------------------|
| 8 EACH  | HINGES      | TA714 4.5 X 4 NRP C26D |
| 2 EACH  | DUMMY TRIM  | 10U93 LJ C26D          |
| 2 EACH  | DOOR CLOSER | P1703BC H - COV 689    |
| 21 FEET | DOOR GASKET | S88 BLACK              |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D114  
912mm x 2670mm x 45mm

EXTERIOR - CAFETERIA

RHR

FRAME TYPE: CWF-9

DOOR TYPE: ALD-2 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

|        |                  |                                  |
|--------|------------------|----------------------------------|
| 1 EACH | CONTINUOUS HINGE | MCK12-HD 120 CLEAR               |
| 1 EACH | EXIT DEVICE      | 43 AD8510F C32D                  |
| 1 EACH | DOOR CLOSER      | 351 UO EN                        |
| 1 EACH | MOUNTING PLATE   | 351-A EN                         |
| 1 EACH | OVERHEAD STOP    | 1-336 630                        |
| 1 LOT  | PERIMETER SEAL   | PERIMETER SEAL BY FRAME SUPPLIER |
| 1 EACH | DOOR SWEEP       | W24S X 36in AL                   |
| 1 EACH | THRESHOLD        | CT45 X 36in                      |
| 1 EACH | DOOR CONTACT     | 1078                             |

**NOTE:**

EXIT ONLY, NO EXTERIOR ACCESS

1 SGL DOOR D115A  
1016mm x 2440mm x 45mm

EXTERIOR - KITCHEN

RH

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

|        |                  |                                  |
|--------|------------------|----------------------------------|
| 1 EACH | CONTINUOUS HINGE | MCK12-HD 120 CLEAR               |
| 1 EACH | EXIT DEVICE      | 43 AD8504J LESS PULL L/C C32D    |
| 1 EACH | RIM CYLINDER     | 21 DG1-34 CMK/GMK C26D           |
| 1 EACH | DOOR PULL CUSTOM | GSH113318 X 1828mm O.A.#4B C32D  |
| 1 EACH | DOOR CLOSER      | 351 UO EN                        |
| 1 EACH | MOUNTING PLATE   | 351-A EN                         |
| 1 EACH | OVERHEAD STOP    | 1-336 630                        |
| 1 LOT  | PERIMETER SEAL   | PERIMETER SEAL BY FRAME SUPPLIER |
| 1 EACH | DOOR SWEEP       | W24S X 36in AL                   |
| 1 EACH | THRESHOLD        | CT45 X 36in                      |
| 1 EACH | DOOR CONTACT     | 1078                             |

1 SLIDING DOOR D115B  
2/813mm x 2440mm x 45mm

KITCHEN

BI-PARTING

DOOR TYPE: ALD-1

ALUMINUM DOOR / ALUMINUM FRAME

|        |                                                                       |                                      |
|--------|-----------------------------------------------------------------------|--------------------------------------|
| 2 EACH | MORTISE CYLINDER<br>(CONFIRM CYLINDER REQUIREMENTS PRIOR TO ORDERING) | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | AUTOMATIC BI-PARTING<br>DOOR SYSTEM                                   | BESAM SL500 CGL X 7IN RAILS          |
| 1 EACH | HARDWARE                                                              | BALANCE OF HARDWARE BY DOOR SUPPLIER |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D115C

KITCHEN

3/762mm x 1525mm x

DOOR TYPE: SGD-1

COUNTER TOP BARN DOORS

3 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

(CONFIRM CYLINDER REQUIREMENTS PRIOR TO ORDERING)

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SGL DOOR D116

ELECTRICAL ROOM

RH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

4 EACH HINGES

TA714 4.5 X 4 C26D

1 EACH POWER TRANSFER

EL-CEPT

1 EACH WIRING HARNESS

QC-C306 44IN HARNESS 8PIN/4PIN DBL  
CONNECTOR

1 EACH WIRING HARNESS

QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL  
CONNECTOR

1 EACH CARD READER

BY OTHERS

1 EACH MORTISE ELECTRIC LOCK

RX-8271 LNJ C26D 24V

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH DOOR CLOSER

1431 O EN

1 EACH KICKPLATE

GSH80A 8in X 26.5in TAPE C32D

1 EACH FLOOR STOP

GSH 209 C26D

19 FEET DOOR GASKET

S88 BLACK

1 EACH TECHNICAL DRAWING

SECURITY DOOR ELEVATION

1 EACH DOOR CONTACT

1078

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D117A  
1016mm x 2440mm x 45mm

HOLDING ROOM

LH

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 4 EACH  | HINGES                | TA786 5 X 4.5 C26D                               |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH  | DOOR CLOSER           | 351 UO EN                                        |
| 1 EACH  | KICKPLATE             | GSH80A 8in X 38.5in TAPE C32D                    |
| 1 EACH  | FLOOR STOP            | GSH 209 C26D                                     |
| 20 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH  | DOOR CONTACT          | 1078                                             |

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1 SGL DOOR D117B

HOLDING ROOM

RH

1016mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 4 EACH  | HINGES                | TA786 5 X 4.5 C26D                               |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH  | DOOR CLOSER           | 351 UO EN                                        |
| 1 EACH  | KICKPLATE             | GSH80A 8in X 38.5in TAPE C32D                    |
| 1 EACH  | FLOOR STOP            | GSH 209 C26D                                     |
| 20 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH  | DOOR CONTACT          | 1078                                             |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D118  
1016mm x 2440mm x 45mm

EXIT CORRIDOR

RHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                  |                               |
|---------|------------------|-------------------------------|
| 4 EACH  | HINGES           | TA786 5 X 4.5 NRP C26D        |
| 1 EACH  | EXIT DEVICE      | 12-8888J LESS TRIM C32D       |
| 1 EACH  | EXIT DEVICE TRIM | 715-8 ETJ C26D                |
| 1 EACH  | DOOR CLOSER      | 351 P10 EN                    |
| 1 EACH  | KICKPLATE        | GSH80A 8in X 38.5in TAPE C32D |
| 1 EACH  | FLOOR STOP       | GSH 209 C26D                  |
| 20 FEET | DOOR GASKET      | S88 BLACK                     |

1 SGL DOOR D119A

EXTERIOR - LOADING

LHR

1017mm x 2670mm x 45mm

FRAME TYPE: CWF-7

DOOR TYPE: ALD-2 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

|        |                     |                                  |
|--------|---------------------|----------------------------------|
| 1 EACH | CONTINUOUS HINGE    | MCK12-HD 120 CLEAR               |
| 1 EACH | CARD READER         | BY OTHERS                        |
| 1 EACH | EXIT DEVICE         | 43 AD8504J LESS PULL L/C C32D    |
| 1 EACH | RIM CYLINDER        | 21 DG1-34 CMK/GMK C26D           |
| 1 EACH | ELECTRIC STRIKE     | 9600 12/24VDC 630                |
| 1 EACH | DOOR PULL CUSTOM    | GSH113318 X 1828mm O.A.#4B C32D  |
| 1 EACH | DOOR CLOSER         | 351 UO EN                        |
| 1 EACH | MOUNTING PLATE      | 351-A EN                         |
| 1 EACH | OVERHEAD STOP       | 1-336 630                        |
| 1 LOT  | PERIMETER SEAL      | PERIMETER SEAL BY FRAME SUPPLIER |
| 1 EACH | DOOR SWEEP          | W24S X 36in AL                   |
| 1 EACH | THRESHOLD           | CT45 X 36in                      |
| 1 EACH | TECHNICAL DRAWING   | SECURITY DOOR ELEVATION          |
| 1 EACH | REX/MOTION DETECTOR | BY OTHERS                        |
| 1 EACH | DOOR CONTACT        | 1078                             |



## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D119B VESTIBULE - LOADING RHR

1016mm x 2440mm x 45mm

FRAME TYPE: WDF-2 / FRAME DETAIL: SIDELITE

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

|         |             |                               |
|---------|-------------|-------------------------------|
| 4 EACH  | HINGES      | TA786 5 X 4.5 NRP C26D        |
| 1 SET   | DOOR PULL   | GSH1180-2 BTB C32D            |
| 1 EACH  | DOOR CLOSER | 351 P10 EN                    |
| 1 EACH  | KICKPLATE   | GSH80A 8in X 38.5in TAPE C32D |
| 1 EACH  | FLOOR STOP  | GSH 209 C26D                  |
| 20 FEET | DOOR GASKET | S88 BLACK                     |

1 PAIR OF DOORS D120A OPEN OFFICE RHR ACTIVE

2/915mm x 2440mm x 13mm

FRAME TYPE: SGS-41 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SGL DOOR D120B OPEN OFFICE LH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                           |                               |
|---------|---------------------------|-------------------------------|
| 4 EACH  | HINGES                    | TA786 4.5 X 4 C26D            |
| 1 EACH  | MORTISE CLASSROOM LOCKSET | 8237 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER          | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER               | 351 UO EN                     |
| 1 EACH  | KICKPLATE                 | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | OVERHEAD STOP             | 1-336 630                     |
| 18 FEET | DOOR GASKET               | S88 BLACK                     |

1 SLIDING DOOR D121 BREAKOUT RM. BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-9 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D122 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-8 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D123 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-20 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SGL DOOR D124 WATER ENTRY RM. RH  
 915mm x 2440mm x 45mm  
 FRAME TYPE: WDF-1  
 DOOR TYPE: SCD-1  
 WOOD DOOR / WOOD FRAME

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 4 EACH  | HINGES                | TA714 4.5 X 4 C26D                               |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH  | DOOR CLOSER           | 1431 O EN                                        |
| 1 EACH  | KICKPLATE             | GSH80A 8in X 26.5in TAPE C32D                    |
| 1 EACH  | FLOOR STOP            | GSH 209 C26D                                     |
| 19 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH  | DOOR CONTACT          | 1078                                             |

1 SLIDING DOOR D125 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-9 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

Finishing hardware – hollow metal doors and frames – wood doors and frames – locksmithing services  
 Security integration - washroom partitions and accessories – automatic door operators – installation

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D126 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-12 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D127 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-9 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SGL DOOR D128A TRAINING ROOM LH  
915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                           |                               |
|---------|---------------------------|-------------------------------|
| 4 EACH  | HINGES                    | TA786 4.5 X 4 C26D            |
| 1 EACH  | MORTISE CLASSROOM LOCKSET | 8237 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER          | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER               | 351 UO EN                     |
| 1 EACH  | KICKPLATE                 | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | OVERHEAD STOP             | 1-336 630                     |
| 18 FEET | DOOR GASKET               | S88 BLACK                     |

1 SLIDING DOOR D128B STORAGE BI-PARTING  
4/1067mm x 2440mm x 45mm

DOOR TYPE: SCD-1

WOOD DOOR / FRAMELESS

|        |               |                       |
|--------|---------------|-----------------------|
| 2 EACH | SLIDING TRACK | C104 180in ALUMINUM   |
| 1 EACH | FASCIA        | C160 X 180in CA       |
| 8 EACH | HANGERS       | C107-4                |
| 2 EACH | GUIDE         | C1205 BI-PASSING DOOR |
| 8 EACH | FLUSH PULL    | GSH 950 C26D          |
| 8 EACH | STOP          | C100HD TRACK MOUNTED  |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D128C  
4/1067mm x 2440mm x 45mm  
DOOR TYPE: SCD-1  
WOOD DOOR / FRAMELESS

STORAGE

BI-PARTING

|        |                 |                       |
|--------|-----------------|-----------------------|
| 2 EACH | SLIDING TRACK   | C104 180in ALUMINUM   |
| 1 EACH | FASCIA          | C160 X 180in CA       |
| 8 EACH | HANGERS         | C107-4                |
| 2 EACH | GUIDE           | C1205 BI-PASSING DOOR |
| 8 EACH | FLUSH PULL C26D | GSH 950 C26D          |
| 8 EACH | STOP            | C100HD TRACK MOUNTED  |

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1 PAIR OF DOORS D128D  
2/508mm x 3400mm x 45mm  
FRAME TYPE: WDF-1  
DOOR TYPE: SCD-1  
WOOD DOOR / WOOD FRAME

1 LOT      HARDWARE      COMPLETE BY OTHERS

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STORAGE (FOLDING PARTITION DOORS)

LHR/RHRA

1 SGL DOOR D129A  
915mm x 2440mm x 45mm  
FRAME TYPE: WDF-1  
DOOR TYPE: SCD-1  
WOOD DOOR / WOOD FRAME  
3/4 HR Fire Label

TRANING ROOM

RH

|         |                           |                               |
|---------|---------------------------|-------------------------------|
| 4 EACH  | HINGES                    | TA786 4.5 X 4 C26D            |
| 1 EACH  | MORTISE CLASSROOM LOCKSET | 8237 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER          | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER               | 351 UO EN                     |
| 1 EACH  | KICKPLATE                 | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | OVERHEAD STOP             | 1-336 630                     |
| 18 FEET | DOOR GASKET               | S88 BLACK                     |

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1 SLIDING DOOR D129B  
4/1067mm x 2440mm x 45mm  
DOOR TYPE: SCD-1  
WOOD DOOR / FRAMELESS

STORAGE

BI-PARTING

|        |                 |                       |
|--------|-----------------|-----------------------|
| 2 EACH | SLIDING TRACK   | C104 180in ALUMINUM   |
| 1 EACH | FASCIA          | C160 X 180in CA       |
| 8 EACH | HANGERS         | C107-4                |
| 2 EACH | GUIDE           | C1205 BI-PASSING DOOR |
| 8 EACH | FLUSH PULL C26D | GSH 950 C26D          |
| 8 EACH | STOP            | C100HD TRACK MOUNTED  |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D129C  
 4/1067mm x 2440mm x 45mm  
 DOOR TYPE: SCD-1  
 WOOD DOOR / FRAMELESS

STORAGE

BI-PARTING

|        |                 |                       |
|--------|-----------------|-----------------------|
| 2 EACH | SLIDING TRACK   | C104 180in ALUMINUM   |
| 1 EACH | FASCIA          | C160 X 180in CA       |
| 8 EACH | HANGERS         | C107-4                |
| 2 EACH | GUIDE           | C1205 BI-PASSING DOOR |
| 8 EACH | FLUSH PULL C26D | GSH 950 C26D          |
| 8 EACH | STOP            | C100HD TRACK MOUNTED  |

1 SGL DOOR D129D

EXTERIOR - TRAINING ROOM

LHR

915mm x 2670mm x 45mm

FRAME TYPE: CWF-8

DOOR TYPE: ALD-2 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

|        |                  |                                  |
|--------|------------------|----------------------------------|
| 1 EACH | CONTINUOUS HINGE | MCK12-HD 120 CLEAR               |
| 1 EACH | EXIT DEVICE      | 43 AD8510F C32D                  |
| 1 EACH | DOOR CLOSER      | 351 UO EN                        |
| 1 EACH | MOUNTING PLATE   | 351-A EN                         |
| 1 EACH | OVERHEAD STOP    | 1-336 630                        |
| 1 LOT  | PERIMETER SEAL   | PERIMETER SEAL BY FRAME SUPPLIER |
| 1 EACH | DOOR SWEEP       | W24S X 36in AL                   |
| 1 EACH | THRESHOLD        | CT45 X 36in                      |
| 1 EACH | DOOR CONTACT     | 1078                             |

**NOTE:**

EXIT ONLY, NO EXTERIOR ACCESS

1 SGL DOOR D130

VESTIBULE - TERRACE

LHR

915mm x 2440mm x 45mm

FRAME TYPE: WDF-3 / FRAME DETAIL: SIDELITE

DOOR TYPE: SCD-3 / DOOR DETAIL: HALF GLASS

WOOD DOOR / WOOD FRAME

|         |             |                               |
|---------|-------------|-------------------------------|
| 4 EACH  | HINGES      | TA786 4.5 X 4 C26D            |
| 1 SET   | DOOR PULL   | GSH1180-2 BTB C32D            |
| 1 EACH  | DOOR CLOSER | 351 P10 EN                    |
| 1 EACH  | KICKPLATE   | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP  | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET | S88 BLACK                     |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D131

EXTERIOR - TERRACE

LHR

915mm x 2670mm x 45mm

FRAME TYPE: CWF-8

DOOR TYPE: ALD-2 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

|        |                  |                                  |
|--------|------------------|----------------------------------|
| 1 EACH | CONTINUOUS HINGE | MCK12-HD 120 CLEAR               |
| 1 EACH | EXIT DEVICE      | 43 AD8504F LESS PULL L/C C32D    |
| 1 EACH | RIM CYLINDER     | 21 DG1-34 CMK/GMK C26D           |
| 1 EACH | DOOR PULL CUSTOM | GSH113318 X 1828mm O.A.#4B C32D  |
| 1 EACH | DOOR CLOSER      | 351 UO EN                        |
| 1 EACH | MOUNTING PLATE   | 351-A EN                         |
| 1 EACH | OVERHEAD STOP    | 1-336 630                        |
| 1 LOT  | PERIMETER SEAL   | PERIMETER SEAL BY FRAME SUPPLIER |
| 1 EACH | DOOR SWEEP       | W24S X 36in AL                   |
| 1 EACH | THRESHOLD        | CT45 X 36in                      |
| 1 EACH | DOOR CONTACT     | 1078                             |

1 PAIR OF DOORS D132A

EXTERIOR - GYM

LHR/RHR

2/915mm x 2670mm x 45mm

FRAME TYPE: CWF-8

DOOR TYPE: ALD-2 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

|        |                  |                                  |
|--------|------------------|----------------------------------|
| 2 EACH | CONTINUOUS HINGE | MCK12-HD 120 CLEAR               |
| 2 EACH | EXIT DEVICE      | 43 AD8410F C32D                  |
| 2 EACH | DOOR CLOSER      | 351 UO EN                        |
| 2 EACH | MOUNTING PLATE   | 351-A EN                         |
| 2 EACH | OVERHEAD STOP    | 1-336 630                        |
| 1 LOT  | PERIMETER SEAL   | PERIMETER SEAL BY FRAME SUPPLIER |
| 2 EACH | DOOR SWEEP       | W24S X 36in AL                   |
| 1 EACH | THRESHOLD        | CT45 X 72in                      |
| 2 EACH | DOOR CONTACT     | 1078                             |

**NOTE:**

EXIT ONLY, NO EXTERIOR ACCESS

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D132B

GYM

LH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA786 4.5 X 4 C26D            |
| 1 EACH  | MORTISE CLASSROOM<br>LOCKSET | 8237 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 351 UO EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | OVERHEAD STOP                | 1-336 630                     |
| 18 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR D133

CLOAK ROOM

LH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA786 4.5 X 4 C26D            |
| 1 EACH  | MORTISE CLASSROOM<br>LOCKSET | 8237 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 351 UO EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | OVERHEAD STOP                | 1-336 630                     |
| 18 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR D134

MENS WASHROOM

RH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

|                  |               |    |
|------------------|---------------|----|
| 1 SGL DOOR D135A | MENS WASHROOM | LH |
|------------------|---------------|----|

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

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|                  |                 |     |
|------------------|-----------------|-----|
| 1 SGL DOOR D135B | WASHROOM - B.F. | RHR |
|------------------|-----------------|-----|

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

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|                  |               |    |
|------------------|---------------|----|
| 1 SGL DOOR D136A | SHOWER - B.F. | LH |
|------------------|---------------|----|

915mm x 2440mm x 13mm

DOOR TYPE: SGD-2 / DOOR DETAIL: TOP&amp;BOTTOM RAILS

GLASS DOOR / FRAMELESS

|       |          |                    |
|-------|----------|--------------------|
| 1 LOT | HARDWARE | COMPLETE BY OTHERS |
|-------|----------|--------------------|

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|                  |        |    |
|------------------|--------|----|
| 1 SGL DOOR D136B | SHOWER | LH |
|------------------|--------|----|

813mm x 2440mm x 13mm

DOOR TYPE: SGD-2 / DOOR DETAIL: TOP&amp;BOTTOM RAILS

GLASS DOOR / FRAMELESS

|       |          |                    |
|-------|----------|--------------------|
| 1 LOT | HARDWARE | COMPLETE BY OTHERS |
|-------|----------|--------------------|

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D137  
915mm x 2440mm x 45mm

WOMENS WASHROOM

RH

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

1 SGL DOOR D138A

WOMENS WASHROOM

RH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

1 SGL DOOR D138B

WASHROOM - B.F.

LHR

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA314 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

1 SGL DOOR D139A

SHOWER - B.F.

LH

915mm x 2440mm x 13mm

DOOR TYPE: SGD-2 / DOOR DETAIL: TOP&amp;BOTTOM RAILS

GLASS DOOR / FRAMELESS

|       |          |                    |
|-------|----------|--------------------|
| 1 LOT | HARDWARE | COMPLETE BY OTHERS |
|-------|----------|--------------------|

Finishing hardware – hollow metal doors and frames – wood doors and frames – locksmithing services  
Security integration - washroom partitions and accessories – automatic door operators – installation

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D139B

SHOWER

LH

813mm x 2440mm x 13mm

DOOR TYPE: SGD-2 / DOOR DETAIL: TOP&amp;BOTTOM RAILS

GLASS DOOR / FRAMELESS

1 LOT

HARDWARE

COMPLETE BY OTHERS

1 PAIR OF DOORS D204

I.T. CLOSET

RHR ACTIVE

2/813mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

8 EACH HINGES

TA714 4.5 X 4 NRP C26D

1 EACH POWER TRANSFER

EL-CEPT

1 EACH WIRING HARNESS

QC-C306 44IN HARNESS 8PIN/4PIN DBL  
CONNECTOR

1 EACH WIRING HARNESS

QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL  
CONNECTOR

1 EACH CARD READER

BY OTHERS

2 EACH FLUSH BOLT

GSH 401 C26D

1 EACH FLUSH BOLT EXTENSION

36in

1 EACH MORTISE ELECTRIC LOCK

RX-8271 LNJ C26D 24V

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

2 EACH DOOR CLOSER

1431 PS EN - SURFACE MOUNTED

21 FEET DOOR GASKET

S88 BLACK

1 EACH ASTRAGAL

BY DOOR SUPPLIER

2 EACH DOOR CONTACT

1078

1 SGL DOOR D205A

MENS WASHROOM

RH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

4 EACH HINGES

TA714 4.5 X 4 C26D

1 EACH DOOR PULL

GSH4012 TB C32D

1 EACH PUSHPLATE

5in X 20in TAPE C32D

1 EACH DOOR CLOSER

1431 O EN

1 EACH KICKPLATE

GSH80A 8in X 34.5in TAPE C32D

1 EACH FLOOR STOP

GSH 209 C26D

18 FEET DOOR GASKET

S88 BLACK

SIGNAGE BY OTHERS

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D205B  
813mm x 2440mm x 45mm

W.R. STALL

LHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

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1 SGL DOOR D205C

W.R. STALL

LHR

813mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

---

1 SGL DOOR D206A

WOMENS WASHROOM

LH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D206B  
813mm x 2440mm x 45mm

W.R. STALL

RHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

1 SGL DOOR D206C  
813mm x 2440mm x 45mm

W.R. STALL

RHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

1 PAIR OF DOORS D207  
2/813mm x 2440mm x 45mm

ELEC. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 1 SET   | AUTO FLUSHBOLT        | 1848 W/BOTTOM FIRE BOLT C32D                     |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH  | CO-ORDINATOR          | 1700 BLACK PRIME                                 |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D208

JANITORS ROOM

RH

711mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 26.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR D209

STAIRS

LHR

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                     |                               |
|---------|---------------------|-------------------------------|
| 4 EACH  | HINGES              | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D                 |
| 1 EACH  | DOOR CLOSER         | 1431 UO EN - SURFACE MOUNTED  |
| 1 EACH  | KICKPLATE           | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET         | S88 BLACK                     |

1 PAIR OF DOORS D210  
2/762mm x 2440mm x 45mm

ELEC. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 1 SET   | AUTO FLUSHBOLT        | 1848 W/BOTTOM FIRE BOLT C32D                     |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH  | CO-ORDINATOR          | 1700 BLACK PRIME                                 |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D211  
915mm x 2440mm x 45mm

UNIVERSAL WASHROOM

RH

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                              |                                   |
|---------|------------------------------|-----------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D                |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C32D                     |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D            |
| 1 EACH  | ELECTRIC STRIKE              | HES 4500C 630                     |
| 1 EACH  | AUTOMATIC OPERATOR           | HA-8-1 INSWING                    |
| 2 EACH  | PUSH BUTTON                  | CM-45-4 PUSH TO OPEN BF LOGO C32D |
| 1 EACH  | WASHROOM RELAY KIT           | CX-WC11                           |
| 1 EACH  | EMERGENCY ASSISTANCE<br>KIT  | CX-WEC10                          |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 36.5in TAPE C32D     |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                      |
| 18 FEET | DOOR GASKET                  | W21 BLACK                         |
| 1 EACH  | DOOR CONTACT                 | 1078                              |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

## ENTRY

- By keyed lever trim
- By push button, operator powers open
- Enter facility, push (Push To Lock) button, locks strike, outside indicator light turns on, outside button turns off
- In the event of emergency push emergency button, exterior indicator dome light turns on

## EXIT

- By lever trim
- By push button, unlocks strike, operator powers open
- System resets
- Free egress at all times

1 SGL DOOR D212

STAIRS

RHR

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                     |                               |
|---------|---------------------|-------------------------------|
| 4 EACH  | HINGES              | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D                 |
| 1 EACH  | DOOR CLOSER         | 1431 UO EN - SURFACE MOUNTED  |
| 1 EACH  | KICKPLATE           | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET         | S88 BLACK                     |

Finishing hardware – hollow metal doors and frames – wood doors and frames – locksmithing services  
Security integration - washroom partitions and accessories – automatic door operators – installation

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 PAIR OF DOORS D213  
2/762mm x 2440mm x 45mm

I.T. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 2 EACH  | FLUSH BOLT            | GSH 401 C26D                                     |
| 1 EACH  | FLUSH BOLT EXTENSION  | 36in                                             |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

1 SLIDING DOOR D214

BREAKOUT RM.

BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-3 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D215

PHONE BOOTH

BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-31 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D216

OFFICE

BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-8 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

Finishing hardware – hollow metal doors and frames – wood doors and frames – locksmithing services  
Security integration - washroom partitions and accessories – automatic door operators – installation



## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D217 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-5 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D218 BREAKOUT RM. BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-11 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D219 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-5 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D220 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-8 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D221 MEETING ROOM BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-37?? / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D222 MEETING ROOM BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-18 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D223 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-14 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D224 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-15 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D225 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-16 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D226 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-14 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D227 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-17 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

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1 PAIR OF DOORS D304 I.T. CLOSET RHR ACTIVE  
 2/813mm x 2440mm x 45mm  
 FRAME TYPE: WDF-1  
 DOOR TYPE: SCD-1  
 WOOD DOOR / WOOD FRAME

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 2 EACH  | FLUSH BOLT            | GSH 401 C26D                                     |
| 1 EACH  | FLUSH BOLT EXTENSION  | 36in                                             |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

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1 SGL DOOR D305A MENS WASHROOM RH  
 915mm x 2440mm x 45mm  
 FRAME TYPE: WDF-1  
 DOOR TYPE: SCD-1  
 WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D305B  
813mm x 2440mm x 45mm

W.R. STALL

LHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

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1 SGL DOOR D305C

W.R. STALL

LHR

813mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

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1 SGL DOOR D306A

WOMENS WASHROOM

LH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D306B  
813mm x 2440mm x 45mm

W.R. STALL

RHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

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1 SGL DOOR D306C

W.R. STALL

RHR

813mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

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1 PAIR OF DOORS D307

ELEC. CLOSET

RHR ACTIVE

2/813mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 1 SET   | AUTO FLUSHBOLT        | 1848 W/BOTTOM FIRE BOLT C32D                     |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH  | CO-ORDINATOR          | 1700 BLACK PRIME                                 |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D308

JANITORS ROOM

RH

711mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 26.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR D309

STAIRS

LHR

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                     |                               |
|---------|---------------------|-------------------------------|
| 4 EACH  | HINGES              | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D                 |
| 1 EACH  | DOOR CLOSER         | 1431 UO EN - SURFACE MOUNTED  |
| 1 EACH  | KICKPLATE           | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET         | S88 BLACK                     |

1 PAIR OF DOORS D310  
2/762mm x 2440mm x 45mm

ELEC. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                       |                                                     |
|---------|-----------------------|-----------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                              |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                             |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL<br>CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL<br>CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                           |
| 1 SET   | AUTO FLUSHBOLT        | 1848 W/BOTTOM FIRE BOLT C32D                        |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                                |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                              |
| 1 EACH  | CO-ORDINATOR          | 1700 BLACK PRIME                                    |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                        |
| 21 FEET | DOOR GASKET           | S88 BLACK                                           |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                             |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                    |
| 2 EACH  | DOOR CONTACT          | 1078                                                |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D311  
915mm x 2440mm x 45mm

UNIVERSAL WASHROOM

LH

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                              |                                   |
|---------|------------------------------|-----------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D                |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C32D                     |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D            |
| 1 EACH  | ELECTRIC STRIKE              | HES 4500C 630                     |
| 1 EACH  | AUTOMATIC OPERATOR           | HA-8-1 INSWING                    |
| 2 EACH  | PUSH BUTTON                  | CM-45-4 PUSH TO OPEN BF LOGO C32D |
| 1 EACH  | WASHROOM RELAY KIT           | CX-WC11                           |
| 1 EACH  | EMERGENCY ASSISTANCE<br>KIT  | CX-WEC10                          |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 36.5in TAPE C32D     |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                      |
| 18 FEET | DOOR GASKET                  | W21 BLACK                         |
| 1 EACH  | DOOR CONTACT                 | 1078                              |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

## ENTRY

- By keyed lever trim
- By push button, operator powers open
- Enter facility, push (Push To Lock) button, locks strike, outside indicator light turns on, outside button turns off
- In the event of emergency push emergency button, exterior indicator dome light turns on

## EXIT

- By lever trim
- By push button, unlocks strike, operator powers open
- System resets
- Free egress at all times

1 SGL DOOR D312

STAIRS

RHR

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                     |                               |
|---------|---------------------|-------------------------------|
| 4 EACH  | HINGES              | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D                 |
| 1 EACH  | DOOR CLOSER         | 1431 UO EN - SURFACE MOUNTED  |
| 1 EACH  | KICKPLATE           | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET         | S88 BLACK                     |

Finishing hardware – hollow metal doors and frames – wood doors and frames – locksmithing services  
Security integration - washroom partitions and accessories – automatic door operators – installation



## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 PAIR OF DOORS D313  
2/762mm x 2440mm x 45mm

I.T. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 2 EACH  | FLUSH BOLT            | GSH 401 C26D                                     |
| 1 EACH  | FLUSH BOLT EXTENSION  | 36in                                             |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

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1 SLIDING DOOR D314

OFFICE

BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-19 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

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1 SLIDING DOOR D315

OFFICE

BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-46 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

---

1 SLIDING DOOR D316

PHONE BOOTH

BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-4 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

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Finishing hardware – hollow metal doors and frames – wood doors and frames – locksmithing services  
Security integration - washroom partitions and accessories – automatic door operators – installation

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D317 PHONE BOOTH BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-4 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D318 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-6 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D319 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-5 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D320 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-21 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D321 PHONE BOOTH BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-10 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D322 MEETING ROOM BARN  
 915mm x 2750mm x 13mm

FRAME TYPE: SGS-19 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D323 OFFICE BARN  
 915mm x 2750mm x 13mm

FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D324 OFFICE BARN  
 915mm x 2750mm x 13mm

FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D325 OFFICE BARN  
 915mm x 2750mm x 13mm

FRAME TYPE: SGS-8 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D326 OFFICE BARN  
 915mm x 2750mm x 13mm

FRAME TYPE: SGS-20 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D327 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-49 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D328 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-6 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SGL DOOR D329 MEETING ROOM RH  
 915mm x 2440mm x 45mm  
 FRAME TYPE: WDF-1 / FRAME DETAIL: SIDELITE  
 DOOR TYPE: SCD-1  
 WOOD DOOR / WOOD FRAME

|         |                     |                    |
|---------|---------------------|--------------------|
| 4 EACH  | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D      |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D       |
| 1 EACH  | AUTO DR BOTTOM      | CT54 X 36in        |
| 19 FEET | DOOR GASKET         | S88 BLACK          |

1 SLIDING DOOR D330 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-5 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D331 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-21 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D401A

ELEVATOR LOBBY - OFF. ENTRY

RHR

1220mm x 2440mm x

FRAME TYPE: WDF-4 / FRAME DETAIL: SIDELITE

DOOR TYPE: WDF-4 / DOOR DETAIL: ???

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

**NOTE:**

CONFIRM DOOR TYPE

|         |                                                                   |                               |
|---------|-------------------------------------------------------------------|-------------------------------|
| 4 EACH  | HINGES                                                            | TA786 5 X 4.5 NRP C26D        |
| 1 EACH  | MORTISE CLASSROOM<br>LOCKSET                                      | 8237 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER                                                  | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                                                       | 351 P10 EN                    |
| 1 EACH  | KICKPLATE                                                         | GSH80A 8in X 46.5in TAPE C32D |
| 1 EACH  | MAGNETIC HOLDER                                                   | 1560 EN                       |
|         | (MAGNETIC HOLDER, WIRED INTO FIRE ALARM, RELEASE UPON ACTIVATION) |                               |
| 1 EACH  | AUTO DR BOTTOM                                                    | CT54 X 48in                   |
| 20 FEET | DOOR GASKET                                                       | S88 BLACK                     |

1 SGL DOOR D401B

ELEVATOR LOBBY - OFF. ENTRY

LHR

1220mm x 2440mm x

FRAME TYPE: WDF-4 / FRAME DETAIL: SIDELITE

DOOR TYPE: WDF-4 / DOOR DETAIL: ???

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

**NOTE:**

CONFIRM DOOR TYPE

|         |                                                                   |                               |
|---------|-------------------------------------------------------------------|-------------------------------|
| 4 EACH  | HINGES                                                            | TA786 5 X 4.5 NRP C26D        |
| 1 EACH  | MORTISE CLASSROOM<br>LOCKSET                                      | 8237 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER                                                  | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                                                       | 351 P10 EN                    |
| 1 EACH  | KICKPLATE                                                         | GSH80A 8in X 46.5in TAPE C32D |
| 1 EACH  | MAGNETIC HOLDER                                                   | 1560 EN                       |
|         | (MAGNETIC HOLDER, WIRED INTO FIRE ALARM, RELEASE UPON ACTIVATION) |                               |
| 1 EACH  | AUTO DR BOTTOM                                                    | CT54 X 48in                   |
| 20 FEET | DOOR GASKET                                                       | S88 BLACK                     |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 PAIR OF DOORS D404  
2/813mm x 2440mm x 45mm

I.T. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 2 EACH  | FLUSH BOLT            | GSH 401 C26D                                     |
| 1 EACH  | FLUSH BOLT EXTENSION  | 36in                                             |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

1 SGL DOOR D405A  
915mm x 2440mm x 45mm

MENS WASHROOM

RH

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D405B  
813mm x 2440mm x 45mm

W.R. STALL

LHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

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1 SGL DOOR D405C

W.R. STALL

LHR

813mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

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1 SGL DOOR D406A

WOMENS WASHROOM

LH

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                   |                               |
|---------|-------------------|-------------------------------|
| 4 EACH  | HINGES            | TA714 4.5 X 4 C26D            |
| 1 EACH  | DOOR PULL         | GSH4012 TB C32D               |
| 1 EACH  | PUSHPLATE         | 5in X 20in TAPE C32D          |
| 1 EACH  | DOOR CLOSER       | 1431 O EN                     |
| 1 EACH  | KICKPLATE         | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP        | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET       | S88 BLACK                     |
|         | SIGNAGE BY OTHERS |                               |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D406B  
813mm x 2440mm x 45mm

W.R. STALL

RHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

1 SGL DOOR D406C  
813mm x 2440mm x 45mm

W.R. STALL

RHR

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|        |                     |                    |
|--------|---------------------|--------------------|
| 4 EACH | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH | MORTISE PRIVACY SET | 8265 LNJ C26D      |
| 1 EACH | HOOK                | GSH307 C26D        |
| 1 EACH | OVERHEAD STOP       | 55-336 652         |
| 4 EACH | SILENCERS           | GJ64 GREY          |

1 PAIR OF DOORS D407  
2/813mm x 2440mm x 45mm

ELEC. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 1 SET   | AUTO FLUSHBOLT        | 1848 W/BOTTOM FIRE BOLT C32D                     |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH  | CO-ORDINATOR          | 1700 BLACK PRIME                                 |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |



## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D408

JANITORS ROOM

RH

711mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 26.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR D409

STAIRS

LHR

1169mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                     |                               |
|---------|---------------------|-------------------------------|
| 4 EACH  | HINGES              | TA786 5 X 4.5 C26D            |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D                 |
| 1 EACH  | DOOR CLOSER         | 351 UO EN                     |
| 1 EACH  | KICKPLATE           | GSH80A 8in X 44.5in TAPE C32D |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D                  |
| 20 FEET | DOOR GASKET         | S88 BLACK                     |

1 PAIR OF DOORS D410  
2/762mm x 2440mm x 45mm

ELEC. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 1 SET   | AUTO FLUSHBOLT        | 1848 W/BOTTOM FIRE BOLT C32D                     |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH  | CO-ORDINATOR          | 1700 BLACK PRIME                                 |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D411  
915mm x 2440mm x 45mm

UNIVERSAL WASHROOM

LH

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                              |                                   |
|---------|------------------------------|-----------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D                |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C32D                     |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D            |
| 1 EACH  | ELECTRIC STRIKE              | HES 4500C 630                     |
| 1 EACH  | AUTOMATIC OPERATOR           | HA-8-1 INSWING                    |
| 2 EACH  | PUSH BUTTON                  | CM-45-4 PUSH TO OPEN BF LOGO C32D |
| 1 EACH  | WASHROOM RELAY KIT           | CX-WC11                           |
| 1 EACH  | EMERGENCY ASSISTANCE<br>KIT  | CX-WEC10                          |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 36.5in TAPE C32D     |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                      |
| 18 FEET | DOOR GASKET                  | W21 BLACK                         |
| 1 EACH  | DOOR CONTACT                 | 1078                              |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

## ENTRY

- By keyed lever trim
- By push button, operator powers open
- Enter facility, push (Push To Lock) button, locks strike, outside indicator light turns on, outside button turns off
- In the event of emergency push emergency button, exterior indicator dome light turns on

## EXIT

- By lever trim
- By push button, unlocks strike, operator powers open
- System resets
- Free egress at all times

1 SGL DOOR D412

STAIRS

RHR

915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-2 / DOOR DETAIL: NARROWLITE

WOOD DOOR / WOOD FRAME

3/4 HR Fire Label

|         |                     |                               |
|---------|---------------------|-------------------------------|
| 4 EACH  | HINGES              | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D                 |
| 1 EACH  | DOOR CLOSER         | 1431 UO EN - SURFACE MOUNTED  |
| 1 EACH  | KICKPLATE           | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET         | S88 BLACK                     |

Finishing hardware – hollow metal doors and frames – wood doors and frames – locksmithing services  
Security integration - washroom partitions and accessories – automatic door operators – installation

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 PAIR OF DOORS D413  
2/762mm x 2440mm x 45mm

I.T. CLOSET

RHR ACTIVE

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 8 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 2 EACH  | FLUSH BOLT            | GSH 401 C26D                                     |
| 1 EACH  | FLUSH BOLT EXTENSION  | 36in                                             |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 2 EACH  | DOOR CLOSER           | 1431 PS EN - SURFACE MOUNTED                     |
| 21 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | ASTRAGAL              | BY DOOR SUPPLIER                                 |
| 2 EACH  | DOOR CONTACT          | 1078                                             |

1 SLIDING DOOR D414

MEETING ROOM

BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-36 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D415

OFFICE

BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D416

OFFICE

BARN

915mm x 2750mm x 13mm

FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

Finishing hardware – hollow metal doors and frames – wood doors and frames – locksmithing services  
Security integration - washroom partitions and accessories – automatic door operators – installation

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D417 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D418 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D419 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-47 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SGL DOOR D420 PHONE BOOTH RH  
915mm x 2440mm x 45mm

FRAME TYPE: WDF-1

DOOR TYPE: SCD-1

WOOD DOOR / WOOD FRAME

4 EACH HINGES

TA714 4.5 X 4 C26D

1 EACH MORTISE PASSAGE SET

8215 LNJ C26D

1 EACH FLOOR STOP

GSH 209 C26D

1 EACH AUTO DR BOTTOM

CT54 X 36in

19 FEET DOOR GASKET

S88 BLACK

1 SLIDING DOOR D421 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-10 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D422 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-35 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D423 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-47 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D424 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-48 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D425 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D426 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D427 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D428 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-13 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D429 BREAKOUT RM. BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-1 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D430 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

1 SLIDING DOOR D431 OFFICE BARN  
915mm x 2750mm x 13mm

FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES

DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS

GLASS DOOR / FRAMLESS

1 EACH MORTISE CYLINDER

21 DG1-41 CMK/GMK C26D

1 EACH HARDWARE

BALANCE OF HARDWARE BY DOOR SUPPLIER

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D432 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-8 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D433 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-47 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D434 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D435 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-8 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SGL DOOR D436 MEETING ROOM LH  
 915mm x 2440mm x 45mm  
 FRAME TYPE: WDF-1  
 DOOR TYPE: SCD-1  
 WOOD DOOR / WOOD FRAME

|         |                     |                    |
|---------|---------------------|--------------------|
| 4 EACH  | HINGES              | TA714 4.5 X 4 C26D |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D      |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D       |
| 1 EACH  | AUTO DR BOTTOM      | CT54 X 36in        |
| 19 FEET | DOOR GASKET         | S88 BLACK          |



## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SLIDING DOOR D437 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-33 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D438 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-8 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D439 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-7 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D440 OFFICE BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-5 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

1 SLIDING DOOR D441 BREAKOUT RM. BARN  
 915mm x 2750mm x 13mm  
 FRAME TYPE: SGS-2 / FRAME DETAIL: SIDELITES  
 DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS  
 GLASS DOOR / FRAMLESS

|        |                  |                                      |
|--------|------------------|--------------------------------------|
| 1 EACH | MORTISE CYLINDER | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH | HARDWARE         | BALANCE OF HARDWARE BY DOOR SUPPLIER |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

|                                              |                    |                                      |
|----------------------------------------------|--------------------|--------------------------------------|
| 1 SLIDING DOOR D442                          | TENDER CLOSING RM. | BARN                                 |
| 2/915mm x 2750mm x 13mm                      |                    |                                      |
| FRAME TYPE: SGS-34 / FRAME DETAIL: SIDELITES |                    |                                      |
| DOOR TYPE: SGD-1 / DOOR DETAIL: ALL GLASS    |                    |                                      |
| GLASS DOOR / FRAMLESS                        |                    |                                      |
| 2 EACH                                       | MORTISE CYLINDER   | 21 DG1-41 CMK/GMK C26D               |
| 1 EACH                                       | HARDWARE           | BALANCE OF HARDWARE BY DOOR SUPPLIER |

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|                                            |                       |                                                  |
|--------------------------------------------|-----------------------|--------------------------------------------------|
| 1 SGL DOOR D500A                           | MECHANICAL PENTHOUSE  | LHR                                              |
| 915mm x 2440mm x 45mm                      |                       |                                                  |
| FRAME TYPE: PSF-1                          |                       |                                                  |
| DOOR TYPE: HMD-2 / DOOR DETAIL: NARROWLITE |                       |                                                  |
| HOLLOW METAL DOOR / HOLLOW METAL FRAME     |                       |                                                  |
| 3/4 HR Fire Label                          |                       |                                                  |
| 4 EACH                                     | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH                                     | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH                                     | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH                                     | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH                                     | CARD READER           | BY OTHERS                                        |
| 1 EACH                                     | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH                                     | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH                                     | DOOR CLOSER           | 1431 P10 EN                                      |
| 1 EACH                                     | KICKPLATE             | GSH80A 8in X 34.5in TAPE C32D                    |
| 1 EACH                                     | FLOOR STOP            | GSH 209 C26D                                     |
| 1 EACH                                     | AUTO DR BOTTOM        | CT54 X 36in                                      |
| 19 FEET                                    | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH                                     | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH                                     | REX/MOTION DETECTOR   | BY OTHERS                                        |
| 1 EACH                                     | DOOR CONTACT          | 1078                                             |

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## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D500B

MECHANICAL PENTHOUSE

LHR

915mm x 2440mm x 45mm

FRAME TYPE: PSF-1

DOOR TYPE: HMD-2 / DOOR DETAIL: NARROWLITE

HOLLOW METAL DOOR / HOLLOW METAL FRAME

3/4 HR Fire Label

|         |                       |                                                  |
|---------|-----------------------|--------------------------------------------------|
| 4 EACH  | HINGES                | TA714 4.5 X 4 NRP C26D                           |
| 1 EACH  | POWER TRANSFER        | EL-CEPT                                          |
| 1 EACH  | WIRING HARNESS        | QC-C306 44IN HARNESS 8PIN/4PIN DBL CONNECTOR     |
| 1 EACH  | WIRING HARNESS        | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH  | CARD READER           | BY OTHERS                                        |
| 1 EACH  | MORTISE ELECTRIC LOCK | RX-8271 LNJ C26D 24V                             |
| 1 EACH  | MORTISE CYLINDER      | 21 DG1-41 CMK/GMK C26D                           |
| 1 EACH  | DOOR CLOSER           | 1431 P10 EN                                      |
| 1 EACH  | KICKPLATE             | GSH80A 8in X 34.5in TAPE C32D                    |
| 1 EACH  | FLOOR STOP            | GSH 209 C26D                                     |
| 1 EACH  | AUTO DR BOTTOM        | CT54 X 36in                                      |
| 19 FEET | DOOR GASKET           | S88 BLACK                                        |
| 1 EACH  | TECHNICAL DRAWING     | SECURITY DOOR ELEVATION                          |
| 1 EACH  | DOOR CONTACT          | 1078                                             |

1 PAIR OF DOORS D501A

CONTROLLER ROOM

RHR ACTIVE

2/610mm x 2440mm x 45mm

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                                    |                        |
|---------|------------------------------------|------------------------|
| 8 EACH  | HINGES                             | TA714 4.5 X 4 NRP C26D |
| 2 EACH  | FLUSH BOLT                         | GSH 401 C26D           |
| 1 EACH  | FLUSH BOLT EXTENSION               | 36in                   |
| 1 EACH  | MORTISE DEADLOCK                   | 4875 L/C C26D          |
|         | (INSTALL DEADLOCK @ 1219mm A.F.F.) |                        |
| 1 EACH  | MORTISE CYLINDER                   | 21 DG1-41 CMK/GMK C26D |
| 1 EACH  | CYLINDER PULL                      | GSH980 C26D            |
| 2 EACH  | OVERHEAD STOP                      | 55-336 652             |
| 20 FEET | DOOR GASKET                        | S88 BLACK              |
| 1 EACH  | ASTRAGAL                           | BY DOOR SUPPLIER       |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 PAIR OF DOORS D501B  
2/610mm x 2440mm x 45mm

CONTROLLER ROOM

RHR ACTIVE

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                                    |                        |
|---------|------------------------------------|------------------------|
| 8 EACH  | HINGES                             | TA714 4.5 X 4 NRP C26D |
| 2 EACH  | FLUSH BOLT                         | GSH 401 C26D           |
| 1 EACH  | FLUSH BOLT EXTENSION               | 36in                   |
| 1 EACH  | MORTISE DEADLOCK                   | 4875 L/C C26D          |
|         | (INSTALL DEADLOCK @ 1219mm A.F.F.) |                        |
| 1 EACH  | MORTISE CYLINDER                   | 21 DG1-41 CMK/GMK C26D |
| 1 EACH  | CYLINDER PULL                      | GSH980 C26D            |
| 2 EACH  | OVERHEAD STOP                      | 55-336 652             |
| 20 FEET | DOOR GASKET                        | S88 BLACK              |
| 1 EACH  | ASTRAGAL                           | BY DOOR SUPPLIER       |

1 SGL DOOR D502

STAIRS

LHR

1067mm x 2440mm x 45mm

FRAME TYPE: PSF-1

DOOR TYPE: HMD-2 / DOOR DETAIL: NARROWLITE

HOLLOW METAL DOOR / HOLLOW METAL FRAME

3/4 HR Fire Label

|         |                     |                               |
|---------|---------------------|-------------------------------|
| 4 EACH  | HINGES              | TA786 5 X 4.5 C26D            |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D                 |
| 1 EACH  | DOOR CLOSER         | 1431 UO EN - SURFACE MOUNTED  |
| 1 EACH  | KICKPLATE           | GSH80A 8in X 40.5in TAPE C32D |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET         | S88 BLACK                     |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D503 EXTERIOR - ROOF RH

915mm x 2440mm x 45mm

FRAME TYPE: PSF-1

DOOR TYPE: HMD-2 / DOOR DETAIL: NARROWLITE

HOLLOW METAL INSULATED DOOR / HOLLOW METAL FRAME

|        |                                                        |                        |
|--------|--------------------------------------------------------|------------------------|
| 4 EACH | HINGES                                                 | TA386 4.5 X 4 NRP C32D |
| 1 EACH | MORTISE STOREROOM<br>LOCKSET                           | 8204 LNJ C26D          |
| 1 EACH | MORTISE CYLINDER                                       | 21 DG1-41 CMK/GMK C26D |
| 1 EACH | DOOR CLOSER                                            | 351 P3 EN              |
| 1 EACH | OVERHEAD STOP                                          | 9-336 630              |
| 2 EACH | WEATHERSTRIP                                           | W13 96in AL            |
| 1 EACH | WEATHERSTRIP                                           | W20N X 36in            |
|        | (INSTALL W20N HEAD PRIOR TO ALL STOP MOUNTED HARDWARE) |                        |
| 1 EACH | DOOR SWEEP                                             | W24S X 36in AL         |
| 1 EACH | THRESHOLD                                              | CT45 X 36in            |
| 1 EACH | DOOR CONTACT                                           | 1078                   |

1 SGL DOOR D504 STAIRS RHR

915mm x 2440mm x 45mm

FRAME TYPE: PSF-1

DOOR TYPE: HMD-2 / DOOR DETAIL: NARROWLITE

HOLLOW METAL DOOR / HOLLOW METAL FRAME

3/4 HR Fire Label

|         |                     |                               |
|---------|---------------------|-------------------------------|
| 4 EACH  | HINGES              | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D                 |
| 1 EACH  | DOOR CLOSER         | 1431 UO EN - SURFACE MOUNTED  |
| 1 EACH  | KICKPLATE           | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D                  |
| 18 FEET | DOOR GASKET         | S88 BLACK                     |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR D505

EXTERIOR - ROOF

LH

915mm x 2440mm x 45mm

FRAME TYPE: PSF-1

DOOR TYPE: HMD-2 / DOOR DETAIL: NARROWLITE

HOLLOW METAL INSULATED DOOR / HOLLOW METAL FRAME

|        |                                                        |                        |
|--------|--------------------------------------------------------|------------------------|
| 4 EACH | HINGES                                                 | TA386 4.5 X 4 NRP C32D |
| 1 EACH | MORTISE STOREROOM<br>LOCKSET                           | 8204 LNJ C26D          |
| 1 EACH | MORTISE CYLINDER                                       | 21 DG1-41 CMK/GMK C26D |
| 1 EACH | DOOR CLOSER                                            | 351 P3 EN              |
| 1 EACH | OVERHEAD STOP                                          | 9-336 630              |
| 2 EACH | WEATHERSTRIP                                           | W13 96in AL            |
| 1 EACH | WEATHERSTRIP                                           | W20N X 36in            |
|        | (INSTALL W20N HEAD PRIOR TO ALL STOP MOUNTED HARDWARE) |                        |
| 1 EACH | DOOR SWEEP                                             | W24S X 36in AL         |
| 1 EACH | THRESHOLD                                              | CT45 X 36in            |
| 1 EACH | DOOR CONTACT                                           | 1078                   |

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1 SGL DOOR DT01A  
915mm x 2670mm x 45mm

EXTERIOR - ENTRY

RHR

FRAME TYPE: CWF-15

DOOR TYPE: ALD-2 / DOOR DETAIL: FULL GLASS

ALUMINUM DOOR / ALUMINUM FRAME

|        |                     |                                   |
|--------|---------------------|-----------------------------------|
| 1 EACH | CONTINUOUS HINGE    | MCK12-HD 120 CLEAR                |
| 1 EACH | CARD READER         | BY OTHERS                         |
| 1 EACH | EXIT DEVICE         | 43 AD8504J LESS PULL L/C C32D     |
| 1 EACH | RIM CYLINDER        | 21 DG1-34 CMK/GMK C26D            |
| 1 EACH | ELECTRIC STRIKE     | 9600 12/24VDC 630                 |
| 1 EACH | DOOR PULL CUSTOM    | GSH113318 X 1828mm O.A.#4B C32D   |
| 1 EACH | AUTOMATIC OPERATOR  | HA-8-1                            |
| 2 EACH | PUSH BUTTON         | CM-45-4 PUSH TO OPEN BF LOGO C32D |
| 1 EACH | INTERFACE RELAY     | CX-12 SWITCHING NETWORK           |
| 1 EACH | OVERHEAD STOP       | 1-336 630                         |
| 1 LOT  | PERIMETER SEAL      | PERIMETER SEAL BY FRAME SUPPLIER  |
| 1 EACH | DOOR SWEEP          | W24S X 36in AL                    |
| 1 EACH | THRESHOLD           | CT45 X 36in                       |
| 1 EACH | TECHNICAL DRAWING   | SECURITY DOOR ELEVATION           |
| 1 EACH | REX/MOTION DETECTOR | BY OTHERS                         |
| 1 EACH | DOOR CONTACT        | 1078                              |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

**ENTRY**

- By keyed trim
- By pull trim when latch bolts doogged or electric strike is unlocked by card reader system
- By valid card, after hours, unlocks electric strike, activates outside push button, manually pull door open or by push button, operator powers door open

**EXIT**

- By exit device
- By push button, unlocks electric strike, operator powers door open
- Free egress at all times

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR DT01B

VESTIBULE - TECHNICIANS BAY

RHR

915mm x 2440mm x 45mm

FRAME TYPE: PSF-5 / FRAME DETAIL: SIDELITE

DOOR TYPE: HMD-3 / DOOR DETAIL: HALF GLASS

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|        |                    |                                   |
|--------|--------------------|-----------------------------------|
| 4 EACH | HINGES             | TA786 4.5 X 4 C26D                |
| 1 SET  | DOOR PULL          | GSH1180-2 BTB C32D                |
| 1 EACH | AUTOMATIC OPERATOR | HA-8-1                            |
| 2 EACH | PUSH BUTTON        | CM-45-4 PUSH TO OPEN BF LOGO C32D |
| 2 EACH | OVERHEAD STOP      | 1-536 630                         |
| 1 EACH | TECHNICAL DRAWING  | SECURITY DOOR ELEVATION           |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

ENTRY

- By pull trim

- By push button, operator powers door open

EXIT

- By pull trim

- By push button, operator powers door open

- Free egress at all times

1 PAIR OF DOORS DT02

TECHNICIANS BAY

RH ACTIVE

2/915mm x 2440mm x 45mm

FRAME TYPE: PSF-6 / FRAME DETAIL: SIDELITES

DOOR TYPE: HMD-3 / DOOR DETAIL: HALF GLASS

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                           |                        |
|---------|---------------------------|------------------------|
| 8 EACH  | HINGES                    | TA786 4.5 X 4 C26D     |
| 2 EACH  | FLUSH BOLT                | GSH 401 C26D           |
| 1 EACH  | FLUSH BOLT EXTENSION      | 36in                   |
| 1 EACH  | MORTISE CLASSROOM LOCKSET | 8237 LNJ C26D          |
| 1 EACH  | MORTISE CYLINDER          | 21 DG1-41 CMK/GMK C26D |
| 2 EACH  | DOOR CLOSER               | 351 UO EN              |
| 2 EACH  | OVERHEAD STOP             | 1-336 630              |
| 22 FEET | DOOR GASKET               | S88 BLACK              |
| 1 EACH  | ASTRAGAL                  | BY DOOR SUPPLIER       |



## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR DT03  
915mm x 2440mm x 45mm

OFFICE - SUPERINTENDENTS

RH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                        |                               |
|---------|------------------------|-------------------------------|
| 4 EACH  | HINGES                 | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE OFFICE LOCKSET | 8205 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER       | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | KICKPLATE              | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP             | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET            | S88 BLACK                     |

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1 SGL DOOR DT06

UNIVERSAL WASHROOM

LH

915mm x 2440mm x 45mm

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                           |                                   |
|---------|---------------------------|-----------------------------------|
| 4 EACH  | HINGES                    | TA714 4.5 X 4 C26D                |
| 1 EACH  | MORTISE STOREROOM LOCKSET | 8204 LNJ C32D                     |
| 1 EACH  | MORTISE CYLINDER          | 21 DG1-41 CMK/GMK C26D            |
| 1 EACH  | ELECTRIC STRIKE           | HES 4500C 630                     |
| 1 EACH  | AUTOMATIC OPERATOR        | HA-8-1 INSWING                    |
| 2 EACH  | PUSH BUTTON               | CM-45-4 PUSH TO OPEN BF LOGO C32D |
| 1 EACH  | WASHROOM RELAY KIT        | CX-WC11                           |
| 1 EACH  | EMERGENCY ASSISTANCE KIT  | CX-WEC10                          |
| 1 EACH  | KICKPLATE                 | GSH80A 8in X 36.5in TAPE C32D     |
| 1 EACH  | FLOOR STOP                | GSH 209 C26D                      |
| 18 FEET | DOOR GASKET               | W21 BLACK                         |
| 1 EACH  | DOOR CONTACT              | 1078                              |

**NOTE:**

Operator(s) only, supply & installed, All electrical rough-in, including low voltage wire, cable, power supply, conduit, back boxes and blocking, by others.

Sequence of operation:

**ENTRY**

- By keyed lever trim
- By push button, operator powers open
- Enter facility, push (Push To Lock) button, locks strike, outside indicator light turns on, outside button turns off
- In the event of emergency push emergency button, exterior indicator dome light turns on

**EXIT**

- By lever trim
  - By push button, unlocks strike, operator powers open
  - System resets
  - Free egress at all times
-

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR DT07  
915mm x 2440mm x 45mm

SOIL BAY

RH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR DT09A  
915mm x 2440mm x 45mm

PROCTER ROOM

RH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR DT09B  
915mm x 2440mm x 45mm

PROCTER ROOM

LH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR DT10  
915mm x 2440mm x 45mm

RECYCLE ROOM

RH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                     |                               |
|---------|---------------------|-------------------------------|
| 4 EACH  | HINGES              | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE PASSAGE SET | 8215 LNJ C26D                 |
| 1 EACH  | DOOR CLOSER         | 1431 O EN                     |
| 1 EACH  | KICKPLATE           | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP          | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET         | S88 BLACK                     |

1 SGL DOOR DT11A  
915mm x 2440mm x 45mm

SHAKER ROOM

RH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR DT11B  
915mm x 2440mm x 45mm

SHAKER ROOM

LH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 PAIR OF DOORS DT12 CORRIDOR LHR/RHR

2/1067mm x 2440mm x 45mm

FRAME TYPE: PSF-1

DOOR TYPE: HMD-3 / DOOR DETAIL: HALF GLASS

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |               |                      |
|---------|---------------|----------------------|
| 8 EACH  | HINGES        | TA786 5 X 4.5 C26D   |
| 2 EACH  | DOOR PULL     | GSH4012 TB C32D      |
| 2 EACH  | PUSHPLATE     | 5in X 20in TAPE C32D |
| 2 EACH  | DOOR CLOSER   | 351 UO EN            |
| 2 EACH  | OVERHEAD STOP | 1-336 630            |
| 23 FEET | DOOR GASKET   | S88 BLACK            |
| 1 SET   | ASTRAGAL SEAL | W25 AL 8ft           |

1 PAIR OF DOORS DT13 SAMPLE STORAGE LHR/RHR

2/1067mm x 2440mm x 45mm

FRAME TYPE: PSF-1

DOOR TYPE: HMD-3 / DOOR DETAIL: HALF GLASS

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |               |                      |
|---------|---------------|----------------------|
| 8 EACH  | HINGES        | TA786 5 X 4.5 C26D   |
| 2 EACH  | DOOR PULL     | GSH4012 TB C32D      |
| 2 EACH  | PUSHPLATE     | 5in X 20in TAPE C32D |
| 2 EACH  | DOOR CLOSER   | 351 UO EN            |
| 1 SET   | ASTRAGAL SEAL | W25 AL 8ft           |
| 2 EACH  | OVERHEAD STOP | 1-336 630            |
| 23 FEET | DOOR GASKET   | S88 BLACK            |

1 PAIR OF DOORS DT14A  
2/1067mm x 2440mm x 45mm

EXTERIOR - LOADING

LHR/RHRA

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL INSULATED DOOR / HOLLOW METAL FRAME TB

|        |                                                        |                                                  |
|--------|--------------------------------------------------------|--------------------------------------------------|
| 8 EACH | HINGES                                                 | TA386 5 X 4.5 NRP C32D                           |
| 1 EACH | POWER TRANSFER                                         | EL-CEPT                                          |
| 1 EACH | WIRING HARNESS                                         | QC-C1500P 15FT HARNESS X 8PIN/4PIN SGL CONNECTOR |
| 1 EACH | WIRING HARNESS                                         | QC-C012P 12IN HARNESS 8PIN/4PIN SINGLE CONNECTOR |
| 1 EACH | CARD READER                                            | BY OTHERS                                        |
| 1 EACH | REMOVABLE MULLION                                      | 980 EN 96in                                      |
| 1 EACH | EXIT DEVICE                                            | 8888F C32D                                       |
| 1 EACH | ELECTRONIC EXIT DEVICE                                 | 56-8810J C32D                                    |
| 1 EACH | RIM CYLINDER                                           | 21 DG1-34 CMK/GMK C26D                           |
| 2 EACH | DOOR PULL                                              | GSH1180-2 TB C32D                                |
| 2 EACH | DOOR CLOSER                                            | 351 P3 EN                                        |
| 2 EACH | OVERHEAD STOP                                          | 9-336 630                                        |
| 2 EACH | WEATHERSTRIP                                           | W20N X 48in                                      |
|        | (INSTALL W20N HEAD PRIOR TO ALL STOP MOUNTED HARDWARE) |                                                  |
| 2 EACH | DOOR SWEEP                                             | W24S X 36in AL                                   |
| 1 EACH | THRESHOLD                                              | CT45 X 84in AL                                   |
| 1 EACH | TECHNICAL DRAWING                                      | SECURITY DOOR ELEVATION                          |
| 1 EACH | REX/MOTION DETECTOR                                    | BY OTHERS                                        |
| 2 EACH | DOOR CONTACT                                           | 1078                                             |

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR DT14B  
915mm x 2440mm x 45mm

EXTERIOR - LOADING

RHR

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL INSULATED DOOR / HOLLOW METAL FRAME TB

|        |                                                        |                         |
|--------|--------------------------------------------------------|-------------------------|
| 4 EACH | HINGES                                                 | TA386 4.5 X 4 NRP C32D  |
| 1 EACH | CARD READER                                            | BY OTHERS               |
| 1 EACH | EXIT DEVICE                                            | 8888F C32D              |
| 1 EACH | RIM CYLINDER                                           | 21 DG1-34 CMK/GMK C26D  |
| 1 EACH | ELECTRIC STRIKE                                        | 9600 12/24VDC 630       |
| 1 EACH | DOOR PULL                                              | GSH1180-2 TB C32D       |
| 1 EACH | DOOR CLOSER                                            | 351 P3 EN               |
| 1 EACH | OVERHEAD STOP                                          | 9-336 630               |
| 1 EACH | WEATHERSTRIP                                           | W20N X 36in             |
|        | (INSTALL W20N HEAD PRIOR TO ALL STOP MOUNTED HARDWARE) |                         |
| 1 EACH | DOOR SWEEP                                             | W24S X 36in AL          |
| 1 EACH | THRESHOLD                                              | CT45 X 36in             |
| 1 EACH | TECHNICAL DRAWING                                      | SECURITY DOOR ELEVATION |
| 1 EACH | REX/MOTION DETECTOR                                    | BY OTHERS               |
| 1 EACH | DOOR CONTACT                                           | 1078                    |

1 O/H DOOR DT14C

EXTERIOR - LOADING

3050mm x 4125mm x

FRAME TYPE: PSF-7

DOOR TYPE: SMD-1 / DOOR DETAIL: VISIONLITES

SECTIONAL DOOR / STEEL FRAME - BY OTHERS

|       |          |                    |
|-------|----------|--------------------|
| 1 LOT | HARDWARE | COMPLETE BY OTHERS |
|-------|----------|--------------------|

1 O/H DOOR DT14D

EXTERIOR - LOADING

3050mm x 4125mm x

FRAME TYPE: PSF-7

DOOR TYPE: SMD-1 / DOOR DETAIL: VISIONLITES

SECTIONAL DOOR / STEEL FRAME - BY OTHERS

|       |          |                    |
|-------|----------|--------------------|
| 1 LOT | HARDWARE | COMPLETE BY OTHERS |
|-------|----------|--------------------|

## TOMLINSON - NEW BUILDING

Date: 21-Sep-16

1 SGL DOOR DT15  
915mm x 2440mm x 45mm

I.T. STORAGE

LH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR DT16  
915mm x 2440mm x 45mm

NUCLEAR STORAGE

RH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

1 SGL DOOR DT17  
915mm x 2440mm x 45mm

MECH./ELEC. ROOM

LH

FRAME TYPE: PSF-1

DOOR TYPE: HMD-1

HOLLOW METAL DOOR / HOLLOW METAL FRAME

3/4 HR Fire Label

|         |                              |                               |
|---------|------------------------------|-------------------------------|
| 4 EACH  | HINGES                       | TA714 4.5 X 4 C26D            |
| 1 EACH  | MORTISE STOREROOM<br>LOCKSET | 8204 LNJ C26D                 |
| 1 EACH  | MORTISE CYLINDER             | 21 DG1-41 CMK/GMK C26D        |
| 1 EACH  | DOOR CLOSER                  | 1431 O EN                     |
| 1 EACH  | KICKPLATE                    | GSH80A 8in X 34.5in TAPE C32D |
| 1 EACH  | FLOOR STOP                   | GSH 209 C26D                  |
| 19 FEET | DOOR GASKET                  | S88 BLACK                     |

TRILLIUM ARCHITECTURAL PRODUCTS LTD.

Project#: P000040680

TOMLINSON - NEW BUILDING

Date: 21-Sep-16

Z-MISL

|         |             |                         |
|---------|-------------|-------------------------|
| 15 EACH | CUT KEY     | CONSTRUCTION MASTER KEY |
| 20 EACH | CUT KEY     | MASTER KEY              |
| 1 EACH  | KEY CABINET | KEY CABINET AWC 150-S   |

END OF SCHEDULE

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**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.
- .2 Section 05 73 10 - Glazed Guardrail System.
- .3 Section 08 11 00 - Metal Doors and Frames.
- .4 Section 08 11 16 - Aluminum Doors and Frames.
- .5 Section 08 14 16 - Flush Wood Doors.
- .6 Section 08 44 13 - Glazed Aluminum Curtain Walls.

**1.02 REFERENCES**

- .1 American National Standards Institute (ANSI).
  - .1 ANSI Z97.1-2015. Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .2 American Society for Testing and Materials International (ASTM).
  - .1 ASTM C542-05(2011). Standard Specification for Lock-Strip Gaskets.
  - .2 ASTM C1048-12e1. Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
  - .3 ASTM C1503-08(2013). Standard Specification for Silvered Flat Glass Mirror.
  - .4 ASTM D638-14. Standard Test Method for Tensile Properties of Plastics.
  - .5 ASTM D648-16. Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
  - .6 ASTM D790-15e2. Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .7 ASTM D792-13. Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
  - .8 ASTM D2240-15. Standard Test Method for Rubber Property-Durometer Hardness.
  - .9 ASTM D5026-15. Standard Test Method for Plastics: Dynamic Mechanical Properties: In Tension.
  - .10 ASTM E1300-12ae1. Standard Practice for Determining Load Resistance of Glass in Buildings.
- .3 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN/ULC-S101-14. Standard Methods of Fire Endurance Tests of Building Construction and Materials.
  - .2 CAN/ULC-S104-15. Standard Method for Fire Tests of Door Assemblies.
- .4 Glass Association of North American (GANA).
  - .1 GANA Glazing Manual - 50<sup>th</sup> Anniversary edition 2008.
  - .2 GANA Laminated Glazing Reference Manual - 2009.
  - .3 GANA Sealant Manual - 2008.
- .5 Insulating Glass Manufacturers Alliance (IGMA).
  - .1 IGCC-IGMA Certification Program Manual.

### 1.03 PERFORMANCE REQUIREMENTS

- .1 Provide glass and glazing materials to maintain the continuity of building vapour and air barrier:
  - .1 Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapour barrier seal. Maintain a continuous air barrier and vapour barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- .2 Size glass thicknesses to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with NBC.
- .3 Provide glass components and systems capable of withstanding normal thermal movements, wind loads and impact loads, without failure, including loss due to ineffective manufacture, fabrication and installation, deterioration of glazing materials and other defects in construction.
- .4 Provide glass thickness and strengths (laminated or tempered) required to meet or exceed the following criteria based on project loads and in-service conditions per ASTM E1300.
  - .1 Minimum thickness of tempered or laminated products is selected, so that worst-case probability of failure does not exceed 85 breaks per thousand for any glass installed vertically or within 15 degrees of vertical under normal interior loads.
- .5 Design glass thickness and glass unit dimensions to limits established in ASTM E1300. Limit glass deflection to 1/200 or flexural limit of glass with full recovery of glazing materials, whichever is less.
- .6 Utilize design software as endorsed by GANA to perform design calculations in accordance with ASTM E1300.
- .7 Provide fire rated glass and glazing materials to meet the specified fire protection rating. Test products in strict conformance with CAN/ULC-S104 and list by nationally recognized agency having factory inspection service. Construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

### 1.04 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data sheets for each Glass Type, gasket, accessory and sealant.
  - .1 For each Glass Type: provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
  - .2 For each glazing compound: provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colours.
  - .3 Include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit manufacturer's installation / application instructions for each product.
- .4 Submit list of adhesives and sealants showing compliance with VOC and chemical component limits or restrictions requirements.
- .5 Submit 2 copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC for each product. Indicate VOC's during application and curing.
- .6 Submit shop drawings:
  - .1 Indicate each Glass Type including locations. Provide scaled elevations for each location. Indicate glass thicknesses, sizes and profiles. Indicate stops, trim and junctions with adjacent construction.

- .2 Indicate method of installation and glazing, support details and number of anchors, supports, reinforcement and accessories. Indicate location of caulking.
- .3 Indicate dimensions, opening requirements and tolerances, clearance to adjacent construction, anticipated flex and deflection under load, affected related Work, expansion and contraction joint location and details.
- .4 Indicate design requirements for glazing including: thickness, attachment, deflection, seismic, wind, and thermal movement. Provide glass design stamped by Professional Engineer licensed to practice in the Province of Ontario.
- .5 Indicate assembly details and dimensions of fabrication.
- .6 Indicate installation details and sequencing. Indicate method of glass installation. Indicate location and method of sealing glass to frame components.
- .7 Submit duplicate 300 x 300 mm sample panels of each Glass Type. Submit for review and acceptance of each Glass Type.
  - .1 Indicate finish for each Glass Type. Describe coatings and special finishes.
  - .2 Where Glass Types are required in multiple thicknesses, submit samples of each Type in each specified thickness.
  - .3 Submit 300 x 300 samples of sealed unit assemblies.
  - .4 Coloured Glass Types:
    - .1 Submit samples including full range of available colours.
    - .2 Indicate each paint coating including colour range, paint type and appearance.
  - .5 Interlayer: Submit duplicate 300 x 300 mm sample of each type of interlayer. Submit one sample of each type and style of film specified. Submit test reports from approved independent testing laboratory, certifying film's compliance with specified requirements.
  - .6 Submit 300 mm long samples of each glazing gasket, glazing tape, backer rod, bond breaker, and cured sample of sealant material.
- .8 Submit compatibility and adhesion test reports from sealant manufacturer, indicating materials were tested for compatibility and adhesion with glazing sealant, as well as other glazing materials including insulating units.
- .9 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .10 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties. Submit testing and analysis of each glass Type. Submit shop inspection and testing criteria for each glass type.
- .11 Fire Rated Glass: Submit test and engineering data. Submit statement of conformance that the glass comply with specified requirements.
  - .1 Submit independent test data from an accredited testing laboratory approved by the Consultant indicating compliance with the specified Fire Rating requirements. Include a summary sheet outlining the following:
    - .1 Description of the test performed.
    - .2 Table of test results by glass type.

#### **1.05 CLOSEOUT SUBMITTALS**

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

**1.06 QUALITY ASSURANCE**

- .1 Provide product certificates signed by glass manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Perform Work in accordance with GANA Glazing Manual, GANA Sealant Manual, GANA Laminated Glazing Reference Manual and IGMA for glazing installation methods. Maintain one 1 copy on site.
- .3 Provide sealed units certified to IGMA Certification Program Manual.
- .4 Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience. Provide written documentation to Consultant listing projects and degree of involvement.
- .5 Convene pre-installation meeting one month prior to beginning work of this Section or any on-site preparation or application. Glass and Glazing contractor, Consultant and General Contractor will review the following:
  - .1 Verify project requirements.
  - .2 Submission of samples and product data.
  - .3 Review installation and substrate conditions.
  - .4 Co-ordination with other building sub-trades.
  - .5 Review manufacturer's installation instructions and warranty requirements.
  - .6 Preparation of Mock-Ups.
- .6 Arrange for site visit with Consultant prior to start of Work to examine existing site conditions.

**1.07 MOCK-UPS**

- .1 Construct Mock-Ups in accordance with Section 01 45 00 - Quality Control.
- .2 Provide Glass and Glazing materials for Mock-Ups as specified in other sections where Glass materials are included as part of a Mock-Up.

**1.08 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect glazing and frames from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. Remove for reuse and return to manufacturer all pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21.

**1.09 AMBIENT CONDITIONS**

- .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.

- .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

## Part 2 Products

### 2.01 GLASS TYPES

- .1 **Type TG:** Tempered glass. Clear float glass. Single pane. Thickness: 6 mm or 12 mm and as indicated in the drawings and schedules. Provide other thicknesses as required to meet glass design loads in accordance with ASTM E1300.
  - .1 Tempered. Comply with ASTM C1048 and ANSI Z97.1. Category II impact test. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.
- .2 **Type FG:** 1 Hour fire rated, impact safety rated glazing. Colourless, wireless, optically clear and free from distortion. Laminated, fire rated, safety glass: composed of multiple layers of colourless, wireless, low-iron, float glass and clear intumescent interlayers to achieve a 1 hour fire rating when tested in accordance with CAN/ULC-S104 and CAN/ULC-S101. Glazing to provide smoke and flame barrier and protection against radiant and conductive heat transfer with limited temperature rise on the unexposed face. Test glass to meet specified fire rating. Properties as follows:
  - .1 Impact Safety rated: tempered glass to ASTM C1048 and ANSI Z97.1. Category I and II impact rating.
  - .2 Thickness: 23 mm.
  - .3 Weight: 55.2 kg per square meter.
  - .4 U Value: 0.83.
  - .5 Daylight transmission: 87%.
  - .6 STC Rating: 41 dB.
  - .7 Labeling: each pane of Fire Rated Glass to bear a permanent, non-removable label of Underwriters Laboratories and/or Intertek Testing Services (Warnock-Hersey) certifying it for use in tested and rated fire protective assemblies.
  - .8 Bite: minimum allowable bite 12.7 mm.
  - .9 Provide fire rated glazing accessories for installation of fire rated glass.
    - .1 Glazing Tape: closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air and vapour seal.
    - .2 Setting Blocks: calcium silicate; match the glass thickness by 100 mm long x 5 mm thick.
    - .3 Spacers: neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.
    - .4 Silicone sealant: one part neutral curing silicone, medium modulus sealant, Type S; Grade NS, Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent). Use Exposure: NT. Uses: substrates G, A, and O as applicable.
- .3 **Type TL:** 17.52 mm clear Tempered, laminated safety glass. 2 layers of 8.0 mm clear float glass with interlayer. Fully tempered to ASTM C1048 and ANSI Z97.1. Category II impact test. Kind: FT. Quality Q3. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.

- .1 Edge treatment: all edges bevelled and polished on both sides prior to tempering where they will be exposed in the final assembly. 2 mm bevel unless otherwise indicated.
- .2 Laminate glass by manufacturer's standard heat and pressure process.
- .3 Interlayer: stiff, advanced polymer. Architectural safety glass interlayer. Properties as follows:
  - .1 Thickness: 1.52 mm.
  - .2 Color: clear.
  - .3 Young's modulus: to ASTM D5026: 43kpsi.
  - .4 Tensile strength: to ASTM D638: 5 kpsi.
  - .5 Elongation: to ASTM D638: 400 %.
  - .6 Density: to ASTM D792: 0.95 g per cubic cm.
  - .7 Flex modulus: to ASTM D790: 50 kpsi at 23 degrees C.
  - .8 Heat deflection temperature to ASTM D648: 0.46 MPa at 110 degrees F.
  - .9 Melting point: 94 degrees C.
  - .10 Weathering durability: excellent weathering characteristics. No delamination, edge cloud or undesired changes in haze or YID when subjected to weathering conditions including the following:
    - .1 Outdoor natural weathering in Florida: hot and humid 180 month exposure.
    - .2 Outdoor accelerated weathering in Arizona: harsh, dry, very high level of solar irradiance. 96 month equivalent exposure (960 kilolangleys) to EMMA test method.
    - .3 Laboratory accelerated weathering: high radiation, light and dark cycles. 60 month equivalent exposure.
  - .11 Standard of Acceptance: DuPont SentryGlas Ionoplast.
- .4 **Type GV Option 1:** Double Glazed, hermetically sealed unit. 25 mm overall thickness. Tempered exterior pane. Composed as follows:
  - .1 Exterior pane: 6 mm thick, solar control, Low E glass. Neutral reflective. Properties as follows when installed in a sealed panel:
    - .1 UV light transmittance: 12 %.
    - .2 Visible light transmittance: 42 %.
    - .3 Visible light reflectance: 32 % exterior. 14 % interior.
    - .4 U value: 1.6.
    - .5 Shading coefficient: 0.27.
    - .6 Solar Heat Gain Co-efficient: 0.23.
    - .7 Light to Solar Gain: 1.83.
    - .8 Low E coating: surface 2.
    - .9 Acceptable Material: PPG Solarban R100.
    - .10 Tempered. Comply with ASTM C1048 and ANSI Z97.1. Category II impact test. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.
  - .2 Inter-cavity space thickness: 12.5 mm between panes. Argon filled.
  - .3 Spacer: edge tech, low conductive spacer. Thickness as required to create specified cavity.
  - .4 Interior: 6 mm thick, clear float glass.

- .5 **Type GV Option 2:** Double Glazed, hermetically sealed unit. 25 mm overall thickness. Tempered both panes. Composed as follows:
- .1 Exterior pane: 6 mm thick, solar control, Low E glass. Neutral reflective. Properties as follows when installed in a sealed panel:
    - .1 UV light transmittance: 12 %.
    - .2 Visible light transmittance: 42 %.
    - .3 Visible light reflectance: 32 % exterior. 14 % interior.
    - .4 U value: 1.6.
    - .5 Shading coefficient: 0.27.
    - .6 Solar Heat Gain Co-efficient: 0.23.
    - .7 Light to Solar Gain: 1.83.
    - .8 Low E coating: surface 2.
    - .9 Acceptable Material: PPG Solarban R100.
    - .10 Tempered. Comply with ASTM C1048 and ANSI Z97.1. Category II impact test. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.
  - .2 Inter-cavity space thickness: 12.5 mm between panes. Argon filled.
  - .3 Spacer: edge tech, low conductive spacer. Thickness as required to create specified cavity.
  - .4 Interior: 6 mm thick, clear float glass. Tempered. Comply with ASTM C1048 and ANSI Z97.1. Category II impact test. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.
- .6 **Type GV Option 3:** Double Glazed, hermetically sealed unit. 25 mm overall thickness. Tempered interior pane. Composed as follows:
- .1 Exterior pane: 6 mm thick, solar control, Low E glass. Neutral reflective. Properties as follows when installed in a sealed panel:
    - .1 UV light transmittance: 12 %.
    - .2 Visible light transmittance: 42 %.
    - .3 Visible light reflectance: 32 % exterior. 14 % interior.
    - .4 U value: 1.6.
    - .5 Shading coefficient: 0.27.
    - .6 Solar Heat Gain Co-efficient: 0.23.
    - .7 Light to Solar Gain: 1.83.
    - .8 Low E coating: surface 2.
    - .9 Acceptable Material: PPG Solarban R100.
  - .2 Inter-cavity space thickness: 12.5 mm between panes. Argon filled.
  - .3 Spacer: edge tech, low conductive spacer. Thickness as required to create specified cavity.
  - .4 Interior: 6 mm thick, clear float glass. Tempered. Comply with ASTM C1048 and ANSI Z97.1. Category II impact test. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.
- .7 **Type GS:** Double Glazed, hermetically sealed unit. 25 mm overall thickness. Composed as follows:
- .1 Exterior pane: 6 mm thick, solar control, Low E glass. Neutral reflective. Properties as follows when installed in a sealed panel:



- .1 UV light transmittance: 12 %.
- .2 Visible light transmittance: 42 %.
- .3 Visible light reflectance: 32 % exterior. 14 % interior.
- .4 U value: 1.6.
- .5 Shading coefficient: 0.27.
- .6 Solar Heat Gain Co-efficient: 0.23.
- .7 Light to Solar Gain: 1.83.
- .8 Low E coating: surface 2.
- .9 Acceptable Material: PPG Solarban R100.
- .2 Inter-cavity space thickness: 12.5 mm between panes. Argon filled.
- .3 Spacer: edge tech, low conductive spacer. Thickness as required to create specified cavity.
- .4 Interior: 6 mm thick, spandrel glass. Heat strengthened float glass to ASTM C1048. Kind: HS, (Heat strengthened). Type I, Condition A - uncoated, Class 1 - Clear. Quality Q3. Back painted with opaque or slightly translucent coloured, ceramic coating, fired on the rear face. Color selected by Consultant from full and extended range of RAL colours.
- .8 **Type MI:** Silvered mirror glass to ASTM C1503. 6 mm thick. Mirror Glazing quality. Polished float glass. Mirror backing resistant to sulphur and hydrogen sulphide fumes.
- .1 Apply layer of mirror backing film to back face.

## 2.02 GLAZING FILMS

- .1 Mirror backing film. Composite of tough, specialty polyolefin film laminated to a bi-directional, woven, polyolefin material. Designed to provide superior impact resistance and dimensional stability. Meet Category II mirror shatter-proofing requirements when tested to ANSI Z-97.1 for both vision and tape sides. High performance acrylic adhesive designed for excellent adhesion to mirror backing paints. Excellent performance, durability, and safety when applied as a backing on silvered float glass mirrors or back painted float glass. Excellent temperature performance and humidity resistance.
- .1 Technical properties:
  - .1 Total Thickness: 7.5 mils.
  - .2 Carrier membrane thickness: 6.5 mils.
  - .3 Adhesive thickness: 1.0 mils.
  - .4 Peel adhesion: 18.2 N/25 mm. Shear Strength: greater than 168 hours.

## 2.03 ACCESSORIES

- .1 Setting blocks: neoprene or EPDM or silicone, 80-90 Shore A durometer hardness to ASTM D2240. To suit glazing method, glass light weight and area. Length of 25 mm for each square meter of glazing. Minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height.
- .2 Spacer shims: neoprene or silicone, 50-60 Shore A durometer hardness to ASTM D2240. 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
- .3 Glazing tape:
  - .1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240. Coiled on release paper. Black colour.



- .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2 %, designed for compression of 25 %.
- .4 Glazing splines: resilient polyvinyl chloride or silicone, extruded shape to suit glazing channel retaining slot, colour as selected.
- .5 Lock-strip gaskets: to ASTM C542.
- .6 Mirror attachment accessories:
  - .1 Stainless steel clips.
  - .2 Mirror adhesive, chemically compatible with mirror coating and wall substrate.

## **2.04 FABRICATION**

- .1 Fabricate glass and other glazing products in sizes required to glaze openings indicated, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.
- .2 Glass Identification. Apply manufacturer's label indicating type and thickness to each light of glass. Show position of exterior face when installed, where applicable.
  - .1 Etch manufacturer's label on each light of tempered or laminated glass.

## **Part 3 Execution**

### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
  - .1 Verify that openings for glazing are correctly sized and within tolerance.
  - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
  - .3 Visually inspect substrate in presence of Consultant.
  - .4 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### **3.02 PREPARATION**

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.

### **3.03 INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)**

- .1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Perform work in accordance with GANA Glazing Manual, GANA Laminated Glazing Reference Manual for glazing installation methods.
- .3 Cut glazing tape spline to length; install on glazing light. Seal corners by butting tape and sealing junctions with sealant.

- .4 Place setting blocks at 1/4 or 1/3 points, with edge block maximum 150 mm from corners.
- .5 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- .6 Install removable stops without displacing glazing tape. Exert pressure for full continuous contact.
- .7 Trim protruding tape edge.

**3.04 INSTALLATION: EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)**

- .1 Perform work in accordance with [GANA Glazing Manual, GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, 6 mm below sight line. Seal corners by butting tape and dabbing with sealant.
- .3 Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.
- .4 Place setting blocks at 1/4 or 1/3 points, with edge block maximum 150 mm from corners.
- .5 Rest glazing on setting blocks and push against tape and heel head of sealant with sufficient pressure to attain full contact at perimeter of light or glass unit.
- .6 Install removable stops with spacer strips inserted between glazing and applied stops 6 mm below sight line. Place glazing tape on glazing light or unit with tape flush with sight line.
- .7 Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, maximum 9 mm below sight line.
- .8 Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

**3.05 INSTALLATION: EXTERIOR - WET METHOD (SEALANT AND SEALANT)**

- .1 Perform work in accordance with GANA Glazing Manual, GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2 Place setting blocks at 1/4 or 1/3 points and install glazing light or unit.
- .3 Install removable stops with glazing centred in space by inserting spacer shims both sides at 600 mm intervals, 6 mm below sight line.
- .4 Fill gaps between glazing and stops with sealant to depth of bite on glazing, maximum 9 mm below sight line to ensure full contact with glazing and continue air and vapour seal.
- .5 Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

**3.06 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)**

- .1 Perform work in accordance with GANA Glazing Manual, GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described.

- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Knife trim protruding tape.

### 3.07 **INSTALLATION: INTERIOR WET/DRY METHOD (TAPE AND SEALANT)**

- .1 Perform work in accordance with GANA Glazing Manual, GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2 Cut glazing tape to length and install against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of light or unit.
- .5 Install removable stops, with spacer shims inserted between glazing and applied stops at 600 mm intervals, 6 mm below sight line.
- .6 Fill gaps between light and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.
- .7 Trim protruding tape edge.

### 3.08 **CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
  - .1 Remove traces of primer, caulking. Remove glazing materials from finish surfaces.
  - .2 Remove labels.
  - .3 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

### 3.09 **PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each light with an "X" by using removable plastic tape or paste.
  - .1 Do not mark heat absorbing or reflective glass units.
- .3 Repair damage to adjacent materials caused by glazing installation.

### 3.010 **SCHEDULE**

- .1 Provide Glass types for installation as follows
  - .1 Glazed openings in Fire Rated metal or Fire Rated wood doors: **Type FG.**
  - .2 Glazed openings in Non Fire Rated metal or Non Fire Rated wood doors: **Type TG.**
  - .3 Glazed openings in Fire Rated or Non Fire Rated wood frames including sidelights and transom panels: **Type TG.**
  - .4 Curtain Wall system Ground floor:
    - .1 Where glass panels are located within 850 mm of the floor level at the interior: **Type GV Option 2: Tempered both interior and exterior panes.**

- .2      Remainder of glass panels at ground floor: **Type GV Option1:** Tempered exterior pane.
- .5      Curtain Wall system Second floor:
  - .1      **Type GV Option 1:** Tempered exterior pane.
- .6      Curtain Wall system Third and Fourth floor: **Type GV Option 3.** Tempered interior pane.
- .7      Curtain Wall system Spandrel panels: **Type GS.**
- .8      Interior Glazed Guardrails: **Type TL.**
- .9      Aluminum Doors and Frames:
  - .1      Exterior (installed in Curtain Wall system): **Type GV Option 2.** Tempered both interior and exterior panes.
  - .2      Interior: **Type TG.**
- .10     Non Framed mirrors: **Type MI.**

**END OF SECTION**

| NO | NAME | FLOOR |     | BASE |     | WALLS |     | CEILING |     | REMARKS |
|----|------|-------|-----|------|-----|-------|-----|---------|-----|---------|
|    |      | MAT   | FIN | MAT  | FIN | MAT   | FIN | MAT     | FIN |         |

| GROUND FLOOR |                      |           |     |          |   |                           |                  |             |             |                                                                                                                                                                                                 |
|--------------|----------------------|-----------|-----|----------|---|---------------------------|------------------|-------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 100          | ATRIUM               | CT1<br>ST | -   | -        | - | CONC<br>GYP<br>CT<br>AT1  | EXP<br>P         | CONC<br>AT1 | CONC<br>AT1 | CPT1 bridge flooring, concrete wall finish – board form vertical, water wall tile, acoustic panels in front of water wall. BR base only at GYP walls. No Base at glass and concrete partitions. |
| 101          | EAST VESTIBULE       | CT1       | -   | -        | - | CONC                      | EXP              | CONC        | EXP         |                                                                                                                                                                                                 |
| 102          | WEST VESTIBULE       | CT1       | -   | -        | - | CONC                      | EXP              | CONC        | EXP         |                                                                                                                                                                                                 |
| 103          | ELEVATOR LOBBY       | CT1       | -   | BR<br>MB | - | GYP                       | P1               | CONC        | EXP         | BR base at GYP partitions, MB base at exposed concrete walls                                                                                                                                    |
| 104          | IT CLOSET            | CT1       | -   | CT       | - | CONC<br>GYP               | EXP<br>P1        | CONC        | EXP         |                                                                                                                                                                                                 |
| 105          | MEN'S WASHROOM       | CT5       | -   | CT       | - | CONC<br>GYP<br>CT6<br>CT8 |                  | ACT1        | -           | CT base to match floor tile (also align joints). Refer to interior elevations for locations                                                                                                     |
| 106          | WOMEN'S WASHROOM     | CT5       | -   | CT       | - | CONC<br>GYP<br>CT6<br>CT8 |                  | ACT1        | -           | CT base to match floor tile (also align joints). Refer to interior elevations for locations                                                                                                     |
| 107          | UNIVERSAL WASHROOM   | CT5       | -   | CT       | - | GYP<br>CT                 | P1<br>CT4<br>CT6 | ACT1        | -           | CT base to match floor tile (also align joints) Refer to interior elevations for locations                                                                                                      |
| 108          | JANITOR'S ROOM       | CT1       | -   | CT       | - | CONC<br>GYP               | EXP<br>P1        | GYP         | -           |                                                                                                                                                                                                 |
| 109          | EXIT STAIR A         | CONC      | EXP | -        | - | CONC                      | EXP              | CONC        | EXP<br>P2   |                                                                                                                                                                                                 |
| 110          | ELECTRICAL/IT CLOSET | CT1       | -   | CT       | - | CONC<br>GYP               | EXP<br>P1        | CONC        | EXP<br>P1   |                                                                                                                                                                                                 |

| NO   | NAME                   | FLOOR          |     | BASE     |     | WALLS                            |           | CEILING            |           | REMARKS                                                                                |
|------|------------------------|----------------|-----|----------|-----|----------------------------------|-----------|--------------------|-----------|----------------------------------------------------------------------------------------|
|      |                        | MAT            | FIN | MAT      | FIN | MAT                              | FIN       | MAT                | FIN       |                                                                                        |
| 111  | MAIL ROOM              | CT1            | -   | BR       | -   | GYP                              | P1        | GYP                | P1        |                                                                                        |
| 112  | EXIT STAIR B           | CONC           | Ext | -        | -   | CONC                             | EXP       | CONC               | EXP<br>P2 |                                                                                        |
| 113  | COAT CLOSET            | CT1            | -   | BR       | -   | CONC<br>GYP                      | EXP       | CONC               | EXP<br>P1 |                                                                                        |
| 114  | CAFETERIA              | CT1            | -   | BR<br>MB | -   | CONC<br>GYP<br>AT1<br>CT3<br>CT1 | EXP<br>P1 | CONC<br>AT1<br>AT2 | EXP       | BR base at GYP partitions, MB base at exposed concrete walls                           |
| 115  | KITCHEN                | HF             |     | RB       | -   | CONC<br>GYP                      | HW        | CONC               | EXP       | RB base-refer to specifications for Hygienic wall covering and hygienic floor covering |
| 116  | ELECTRICAL ROOM        | CONC           |     | RB       | -   | CONC<br>GYP                      | EXP<br>P1 | CONC               | EXP       | Sealer to concrete floor                                                               |
| 117  | HOLDING ROOM           | RF             |     | RB       | -   | GYP                              | P1        | CONC               | EXP       |                                                                                        |
| 117B | HOLDING ROOM VESTIBULE | RF             |     | RB       | -   | GYP                              | P1        | CONC               | EXP       |                                                                                        |
| 118  | EXIT CORRIDOR          | CT1            | -   | MB       | -   | GYP<br>CONC                      | EXP<br>P1 | GYP                | P1        |                                                                                        |
| 119  | LOADING VESTIBULE      | CT1            | -   | MB       | -   | GYP                              | P1        | CONC               | EXP       |                                                                                        |
| 120  | OPEN OFFICE            | CPT<br>1,2,3,4 | -   | BR<br>MB | -   | GYP                              | P         | CONC               | EXP       | BR base at GYP partitions, MB base at exposed concrete walls                           |
| 121  | BREAKOUT ROOM          | CPT<br>1,2,3,4 | -   | BR       | -   | GYP                              | P         | CONC               | EXP       |                                                                                        |
| 122  | OFFICE                 | CPT<br>1,2,3,4 | -   | BR       | -   | GYP                              | P         | CONC               | EXP       |                                                                                        |
| 123  | OFFICE                 | CPT<br>1,2,3,4 | -   | BR       | -   | GYP                              | P         | CONC               | EXP       |                                                                                        |
| 124  | WATER ENTRY ROOM       | CONC           | -   | MB       | -   | GYP                              | P         | CONC               | EXP       | Sealer to concrete floor                                                               |

| NO   | NAME               | FLOOR          |     | BASE     |     | WALLS                    |           | CEILING     |           | REMARKS                                                                                         |
|------|--------------------|----------------|-----|----------|-----|--------------------------|-----------|-------------|-----------|-------------------------------------------------------------------------------------------------|
|      |                    | MAT            | FIN | MAT      | FIN | MAT                      | FIN       | MAT         | FIN       |                                                                                                 |
| 125  | OFFICE             | CPT<br>1,2,3,4 | -   | BR<br>MB | -   | GYP                      | P         | CONC        | EXP       | BR base at GYP partitions, MB base at exposed concrete walls                                    |
| 126  | OFFICE             | CPT<br>1,2,3,4 | -   | BR<br>MB | -   | GYP                      | P         | CONC        | EXP       | BR base at GYP partitions, MB base at exposed concrete walls                                    |
| 127  | UNUSED             |                |     |          |     |                          |           |             |           |                                                                                                 |
| 128A | TRAINING ROOM A    | CT1            | -   | BR<br>MB | -   | CONC<br>GYP              | EXP<br>P1 | CONC<br>GYP | EXP<br>P1 | GYP Bulkhead at Folding Partition. BR base at GYP partitions, MB base at exposed concrete walls |
| 129A | TRAINING ROOM B    | CT1            | -   | BR<br>MB | -   | CONC<br>GYP              | EXP<br>P1 | CONC<br>GYP | EXP<br>P1 | GYP Bulkhead at Folding Partition. BR base at GYP partitions, MB base at exposed concrete walls |
| 130  | EXIT CORRIDOR B    | CT1            | -   | MB       | -   | GYP                      | P1        | GYP         | P1        |                                                                                                 |
| 131  | TERRACE VESTIBULE  | CT1            | -   | MB       | -   | GYP                      | P1        | CONC        | EXP       |                                                                                                 |
| 132  | GYM                | CPT5           | -   | RB<br>MB | -   | CONC<br>GYP              | EXP<br>P  | CONC        | EXP       | P colour TBD. BR base at GYP partitions, MB base at exposed concrete walls                      |
| 133  | CLOAK ROOM         | CT1            | -   | RB<br>MB | -   | CONC<br>GYP              | EXP<br>P  | CONC        | EXP       | P colour TBD. BR base at GYP partitions, MB base at exposed concrete walls                      |
| 134  | MEN'S VESTIBULE    | CT5            | -   | CT       | -   | GYP                      | P1        | GYP         | P1        | CT base to match floor tile (also align joints)                                                 |
| 135  | MEN'S WASHROOM     | CT5            | -   | CT       | -   | GYP<br>CT6               | P1        | GYP         | P1        | CT base to match floor tile (also align joints)                                                 |
| 136  | MEN'S CHANGEROOM   | CT5            | -   | CT       | -   | GYP                      | P1        | GYP         | P1        | CT base to match floor tile (also align joints)                                                 |
| 137  | WOMEN'S VESTIBULE  | CT5            | -   | CT       | -   | CONC<br>GYP              | EXP<br>P1 | GYP         | P1        | CT base to match floor tile (also align joints)                                                 |
| 138  | WOMEN'S WASHROOM   | CT5            | -   | CT       | -   | CONC<br>GYP<br>CT6       | EXP<br>P1 | GYP         | P1        | CT base to match floor tile (also align joints)                                                 |
| 139  | WOMEN'S CHANGEROOM | CT5            | -   | CT       | -   | GYP<br>CT6<br>CT7<br>CT8 | P1        | GYP         | P1        | CT base to match floor tile (also align joints)                                                 |

| NO           | NAME              | FLOOR          |          | BASE     |     | WALLS                     |              | CEILING |             | REMARKS                                                                                        |
|--------------|-------------------|----------------|----------|----------|-----|---------------------------|--------------|---------|-------------|------------------------------------------------------------------------------------------------|
|              |                   | MAT            | FIN      | MAT      | FIN | MAT                       | FIN          | MAT     | FIN         |                                                                                                |
| SECOND FLOOR |                   |                |          |          |     |                           |              |         |             |                                                                                                |
| 200          | ATRIUM            | CPT1<br>EP     | EP<br>P1 | RB<br>MB |     | CONC                      | EXP.<br>/ P1 | -       | -           | Bridge –CPT 1, EP on Stair C/D risers and treads. P1 on GYP walls and remaining stair finishes |
| 201          | ELEVATOR LOBBY    | CPT<br>1,2,3,4 |          | BR       |     | GYP                       | P1           | CONC.   | EXP.        |                                                                                                |
| 202          | OPEN OFFICE       | CPT<br>1,2,3,4 |          | RB<br>MB | -   | GYP                       | P            | CONC.   | EXP.        | BR base at GYP partitions, MB base at exposed concrete walls. P colours TBD                    |
| 203          | KITCHEN           | CT1            |          | RB<br>MB |     | CONC<br>GYP               | EXP.<br>/ P1 | AT2     |             | BR base at GYP partitions, MB base at exposed concrete walls. P colours TBD                    |
| 204          | IT CLOSET         | RF             | -        | RB       | -   | GYP                       | P1           | CONC.   | EXP./P<br>1 |                                                                                                |
| 205          | MEN'S WASHROOM    | CT5            | -        | CT       | -   | CONC<br>GYP<br>CT6<br>CT8 |              | ACT1    | -           | CT base to match floor tile (also align joints). Refer to interior elevations for locations    |
| 206          | WOMEN'S WASHROOM  | CT5            | -        | CT       | -   | CONC<br>GYP<br>CT6<br>CT8 |              | ACT1    | -           | CT base to match floor tile (also align joints). Refer to interior elevations for locations    |
| 207          | ELECTRICAL CLOSET | RF             | -        | RB       | -   | GYP                       | P1           | CONC.   | EXP./P<br>1 |                                                                                                |
| 208          | JANITOR'S ROOM    | CT1            | -        | CT       | -   | CONC<br>GYP               | EXP.<br>/ P1 | CONC.   | EXP.        |                                                                                                |
| 209          | EXIT STAIR A      | CONC           | EXP      | -        | -   | CONC                      | EXP          | CONC.   | EXP         |                                                                                                |



| NO  | NAME                  | FLOOR          |     | BASE |     | WALLS       |                  | CEILING |           | REMARKS                                         |
|-----|-----------------------|----------------|-----|------|-----|-------------|------------------|---------|-----------|-------------------------------------------------|
|     |                       | MAT            | FIN | MAT  | FIN | MAT         | FIN              | MAT     | FIN       |                                                 |
|     |                       |                |     |      |     |             |                  |         | P2        |                                                 |
| 210 | ELECTRICAL CLOSET     | RF             | -   | RB   | -   | CONC<br>GYP | EXP.<br>P1       | CONC.   | EXP<br>P1 |                                                 |
| 211 | UNIVERSAL<br>WASHROOM | CT5            |     | CT   | -   | GYP<br>CT   | P1<br>CT4<br>CT6 | ACT1    |           | CT base to match floor tile (also align joints) |
| 212 | EXIT STAIR B          | CONC           | EXP | -    | -   | CONC        | EXP              | CONC    | EXP<br>P2 |                                                 |
| 213 | IT CLOSET             | RF             | -   | RB   | -   | CONC<br>GYP | EXP<br>P1        | CONC    | EXP<br>P1 |                                                 |
| 214 | BREAKOUT ROOM         | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 215 | PHONE BOOTH           | CPT<br>1,2,3,4 |     | RB   |     | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 216 | OFFICE                | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 217 | OFFICE                | CPT<br>1,2,3,4 |     | RB   |     | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 218 | BREAKOUT ROOM         | CPT<br>1,2,3,4 |     | RB   |     | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 219 | OFFICE                | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 220 | OFFICE                | CPT<br>1,2,3,4 |     | RB   |     | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 221 | LARGE MEETING ROOM    | CPT 3          |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 222 | MEETING ROOM          | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 223 | OFFICE                | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 224 | OFFICE                | CPT            |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |

| NO                 | NAME              | FLOOR          |          | BASE     |     | WALLS                     |           | CEILING |           | REMARKS                                                                                        |
|--------------------|-------------------|----------------|----------|----------|-----|---------------------------|-----------|---------|-----------|------------------------------------------------------------------------------------------------|
|                    |                   | MAT            | FIN      | MAT      | FIN | MAT                       | FIN       | MAT     | FIN       |                                                                                                |
|                    |                   | 1,2,3,4        |          |          |     |                           |           |         |           |                                                                                                |
| 225                | OFFICE            | CPT<br>1,2,3,4 |          | RB       | -   | GYP                       | P         | CONC    | EXP       | P colours TBD                                                                                  |
| 226                | OFFICE            | CPT<br>1,2,3,4 |          | RB       | -   | GYP                       | P         | CONC    | EXP       | P colours TBD                                                                                  |
| 227                | OFFICE            | CPT<br>1,2,3,4 |          | RB       | -   | GYP                       | P         | CONC    | EXP       | P colours TBD                                                                                  |
| <b>THIRD FLOOR</b> |                   |                |          |          |     |                           |           |         |           |                                                                                                |
| 300                | ATRIUM            | CPT 1<br>EP    | EP<br>P1 | RB<br>MB |     | CONC<br>GYP               | EXP<br>P1 | -       | -         | Bridge –CPT 1, EP on Stair C/D risers and treads. P1 on GYP walls and remaining stair finishes |
| 301                | ELEVATOR LOBBY    | CPT<br>1,2,3,4 |          | BR       |     | GYP                       | P1        | CONC    | EXP       |                                                                                                |
| 302                | OPEN OFFICE       | CPT<br>1,2,3,4 |          | RB<br>MB | -   | GYP                       | P         | CONC    | EXP       | BR base at GYP partitions, MB base at exposed concrete walls. P colours TBD                    |
| 303                | KITCHEN           | CT1            |          | RB<br>MB |     | CONC<br>GYP               | EXP<br>P1 | AT2     |           | BR base at GYP partitions, MB base at exposed concrete walls. P colours TBD                    |
| 304                | IT CLOSET         | RF             | -        | RB       | -   | GYP                       | P1        | CONC    | EXP<br>P1 |                                                                                                |
| 305                | MEN'S WASHROOM    | CT5            | -        | CT       | -   | CONC<br>GYP<br>CT6<br>CT8 |           | ACT1    | -         | CT base to match floor tile (also align joints). Refer to interior elevations for locations    |
| 306                | WOMEN'S WASHROOM  | CT5            | -        | CT       | -   | CONC<br>GYP<br>CT6<br>CT8 |           | ACT1    | -         | CT base to match floor tile (also align joints). Refer to interior elevations for locations    |
| 307                | ELECTRICAL CLOSET | RF             | -        | RB       | -   | GYP                       | P1        | CONC    | EXP<br>P1 |                                                                                                |

| NO  | NAME                  | FLOOR          |     | BASE |     | WALLS       |                  | CEILING |           | REMARKS                                         |
|-----|-----------------------|----------------|-----|------|-----|-------------|------------------|---------|-----------|-------------------------------------------------|
|     |                       | MAT            | FIN | MAT  | FIN | MAT         | FIN              | MAT     | FIN       |                                                 |
| 308 | JANITOR'S ROOM        | CT1            | -   | CT   | -   | CONC<br>GYP | EXP<br>P1        | CONC    | EXP       |                                                 |
| 309 | EXIT STAIR A          | CONC           | EXP | -    | -   | CONC        | EXP              | CONC    | EXP<br>P2 |                                                 |
| 310 | ELECTRICAL CLOSET     | RF             | -   | RB   | -   | CONC<br>GYP | EXP<br>P1        | CONC    | EXP<br>P1 |                                                 |
| 311 | UNIVERSAL<br>WASHROOM | CT5            |     | CT   | -   | GYP<br>CT   | P1<br>CT4<br>CT6 | ACT1    |           | CT base to match floor tile (also align joints) |
| 312 | EXIT STAIR B          | CONC           | EXP | -    | -   | CONC        | EXP              | CONC    | EXP<br>P2 |                                                 |
| 313 | IT CLOSET             | RF             | -   | RB   | -   | CONC<br>GYP | EXP<br>P1        | CONC    | EXP<br>P1 |                                                 |
| 314 | OFFICE                | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 315 | OFFICE                | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 316 | PHONE BOOTH           | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 317 | PHONE BOOTH           | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 318 | OFFICE                | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 319 | OFFICE                | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 320 | OFFICE                | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |
| 321 | PHONE BOOTH           | CPT<br>1,2,3,4 |     | RB   | -   | GYP         | P                | CONC    | EXP       | P colours TBD                                   |

| NO                  | NAME           | FLOOR          |          | BASE     |     | WALLS       |           | CEILING |     | REMARKS                                                                         |
|---------------------|----------------|----------------|----------|----------|-----|-------------|-----------|---------|-----|---------------------------------------------------------------------------------|
|                     |                | MAT            | FIN      | MAT      | FIN | MAT         | FIN       | MAT     | FIN |                                                                                 |
| 322                 | MEETING ROOM   | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
| 323                 | OFFICE         | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
| 324                 | OFFICE         | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
| 325                 | OFFICE         | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
| 326                 | OFFICE         | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
| 327                 | OFFICE         | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
| 328                 | OFFICE         | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
| 329                 | MEETING ROOM   | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
| 330                 | OFFICE         | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
| 331                 | OFFICE         | CPT<br>1,2,3,4 |          | RB       | -   | GYP         | P         | CONC    | EXP | P colours TBD                                                                   |
|                     |                |                |          |          |     |             |           |         |     |                                                                                 |
| <b>FOURTH FLOOR</b> |                |                |          |          |     |             |           |         |     |                                                                                 |
| 400                 | OPEN (ATRIUM)  | EP             | EP<br>P1 | RB<br>MB |     | CONC<br>GYP | EXP<br>P1 | -       | -   | EP on Stair C/D risers and treads. P1 on GYP walls and remaining stair finishes |
| 401                 | ELEVATOR LOBBY | CPT<br>1,2,3,4 |          | BR       |     | GYP         | P1        | CONC    | EXP |                                                                                 |
| 402                 | OPEN OFFICE    | CPT<br>1,2,3,4 |          | RB<br>MB | -   | GYP         | P         | CONC    | EXP | BR base at GYP partitions, MB base at exposed concrete walls. P colours TBD     |

| NO  | NAME               | FLOOR |     | BASE     |     | WALLS                         |                  | CEILING |           | REMARKS                                                                                     |
|-----|--------------------|-------|-----|----------|-----|-------------------------------|------------------|---------|-----------|---------------------------------------------------------------------------------------------|
|     |                    | MAT   | FIN | MAT      | FIN | MAT                           | FIN              | MAT     | FIN       |                                                                                             |
| 403 | KITCHEN            | CT1   |     | RB<br>MB |     | CONC<br>GYP                   | EXP<br>P1        | AT2     |           | BR base at GYP partitions, MB base at exposed concrete walls. P colours TBD                 |
| 404 | IT CLOSET          | RF    | -   | RB       | -   | GYP                           | P1               | CONC    | EXP<br>P1 |                                                                                             |
| 405 | MEN'S WASHROOM     | CT5   | -   | CT       | -   | CONC<br><br>GYP<br>CT6<br>CT8 |                  | ACT1    | -         | CT base to match floor tile (also align joints). Refer to interior elevations for locations |
| 406 | WOMEN'S WASHROOM   | CT5   | -   | CT       | -   | CONC<br>GYP<br>CT6<br>CT8     |                  | ACT1    | -         | CT base to match floor tile (also align joints). Refer to interior elevations for locations |
| 407 | ELECTRICAL CLOSET  | RF    | -   | RB       | -   | GYP                           | P1               | CONC    | EXP<br>P1 |                                                                                             |
| 408 | JANITOR'S ROOM     | CT1   | -   | CT       | -   | CONC<br>GYP                   | EXP<br>P1        | CONC    | EXP       |                                                                                             |
| 409 | EXIT STAIR A       | CONC  | EXP | -        | -   | CONC                          | EXP              | CONC    | EXP<br>P2 |                                                                                             |
| 410 | ELECTRICAL CLOSET  | RF    | -   | RB       | -   | CONC<br>GYP                   | EXP<br>P1        | CONC    | EXP<br>P1 |                                                                                             |
| 411 | UNIVERSAL WASHROOM | CT5   |     | CT       | -   | GYP<br>CT                     | P1<br>CT4<br>CT6 | ACT1    |           | CT base to match floor tile (also align joints)                                             |
| 412 | EXIT STAIR B       | CONC  | EXP | -        | -   | CONC                          | EXP              | CONC    | EXP<br>P2 |                                                                                             |
| 413 | IT CLOSET          | RF    | -   | RB       | -   | CONC<br>GYP                   | EXP<br>P1        | CONC    | EXP<br>P1 |                                                                                             |
| 414 | MEETING ROOM       | CPT   |     | RB       | -   | GYP                           | P                | CONC    | EXP       |                                                                                             |

| NO  | NAME          | FLOOR          |     | BASE |     | WALLS |     | CEILING |     | REMARKS                  |
|-----|---------------|----------------|-----|------|-----|-------|-----|---------|-----|--------------------------|
|     |               | MAT            | FIN | MAT  | FIN | MAT   | FIN | MAT     | FIN |                          |
|     |               | 1,2,3,4        |     |      |     |       |     |         |     |                          |
| 415 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 416 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 417 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 418 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 419 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 420 | PHONE BOOTH   | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 421 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 422 | SERVER ROOM   | CONC           |     | MB   | -   | GYP   | P   | CONC    | EXP | Sealer to Concrete floor |
| 423 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 424 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 425 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 426 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 427 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 428 | OFFICE        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 429 | BREAKOUT ROOM | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |
| 430 | OFFICE        | CPT            |     | RB   | -   | GYP   | P   | CONC    | EXP |                          |

| NO  | NAME                | FLOOR          |     | BASE |     | WALLS |     | CEILING |     | REMARKS |
|-----|---------------------|----------------|-----|------|-----|-------|-----|---------|-----|---------|
|     |                     | MAT            | FIN | MAT  | FIN | MAT   | FIN | MAT     | FIN |         |
|     |                     | 1,2,3,4        |     |      |     |       |     |         |     |         |
| 431 | OFFICE              | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 432 | OFFICE              | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 433 | OFFICE              | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 434 | OFFICE              | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 435 | OFFICE              | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 436 | MEETING ROOM        | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 437 | OFFICE              | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 438 | OFFICE              | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 439 | OFFICE              | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 440 | OFFICE              | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 441 | BREAKOUT ROOM       | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |
| 442 | TENDER CLOSING ROOM | CPT<br>1,2,3,4 |     | RB   | -   | GYP   | P   | CONC    | EXP |         |

## 1.1 LEGEND

- .1 AC. Exposed Architectural Concrete, unsealed.
- .2 ACT(#) Ceiling Tile In accordance with Section 09 51 13.
- .1 ACT Metalworks M11 White, *Armstrong*.

| NO | NAME | FLOOR |     | BASE |     | WALLS |     | CEILING |     | REMARKS |
|----|------|-------|-----|------|-----|-------|-----|---------|-----|---------|
|    |      | MAT   | FIN | MAT  | FIN | MAT   | FIN | MAT     | FIN |         |

- .3 AT(#) Acoustic Ceiling Panel: In accordance with Section 09 51 13.
  - .1 AT1 Hard Side Cloud White, *Kinetics*.
  - .2 AT2 Hard Side Cloud Sunshine, *Kinetics*.
- .4 AW(#) Acoustic Wall Panel: In accordance with Section 09 53 00.
- .5 BR Reveal Baseboard: 2" high Brushed Aluminum base with 1/4" cove bend recessed in GYP. 1/2". In accordance with Section 09 27 10.
- .6 CH Concrete Hardener Floor Finish: In accordance with Section 03 35 05.
- .7 CPT Carpet Tile: In accordance with Section 09 68 13 - Tile Carpeting.
  - .1 CPT1 On Line 105269, Marigold, *Interface* (25cm x 100cm).
  - .2 CPT2 Concrete Viva Colores 101180, Plateado, *Interface* (50cm x 50cm cut to (2) 25cm x 50cm).
  - .3 CPT3 Human Nature 104214, Nickel, *Interface* (25cm x 100cm).
  - .4 CPT4 Felt 101834, Monochrome, *Interface* (50cm x 50cm cut to (2) 25cm x 50cm).
  - .5 CPT5 On Line, 105266 Aquamarine, *Interface* (25cm x 100cm).
- .8 CT(#) Ceramic Tile: In accordance with Section 09 30 05 - Ceramic Tiling.
  - .1 CT1 Interno 9, Pearl, Lap. RT., *Ciot* (60cm x 120cm).
  - .2 CT2 **Water Wall Stone/Tile TBD Blue.**
  - .3 CT3 Sistem C Turchese Citta, Arch., *Ciot* (10cm x 30cm).
  - .4 CT4 Sistem C Ocra Citta, *Ciot* (10cm x 30cm).
  - .5 CT5 Blocks 5.0, White, Lap. RT., *Ciot* (60cm x 120cm).
  - .6 CT6 Blocks 5.0, Dark, Lap. RT., *Ciot* (60cm x 120cm).
  - .7 CT7 Light Seta Fumo, *Ciot* (5cmx10cm).
  - .8 CT8 Super Super, White, *Ciot* (30cm x 60cm).
- .9 EP Epoxy Coating.
- .10 GYP Gypsum Board: In accordance with Section 09 21 16 - Gypsum Board Assemblies.
- .11 HF Hygienic Flooring: In accordance with Section 09 72 00.



| NO | NAME | FLOOR |     | BASE |     | WALLS |     | CEILING |     | REMARKS |
|----|------|-------|-----|------|-----|-------|-----|---------|-----|---------|
|    |      | MAT   | FIN | MAT  | FIN | MAT   | FIN | MAT     | FIN |         |

- .12 HW Hygienic Wall covering: In accordance with Section 09 72 00.  
.1 Altro Whiterock, White W103-W104, Altro.
- .13 MB Brushed Metal Base: 2" high Brushed Aluminum base with ¼" cove bend, flush mounted to wall. In accordance with Section 09 27 10.
- .14 P# Paint Finish: In accordance with Section 09 90 15 - Painting. Refer to Paint Schedule for colour.  
.1 P1 Quiet Hideaway, **eggshell finish**, *Dulux* (white).  
.2 P2 Colour TBD.  
.3 P3 Colour TBD.
- .15 RB Resilient Floor Base: In accordance with Section 09 65 16 - Resilient Sheet Flooring.
- .16 RF Resilient Flooring: In accordance with Section 09 65 16 - Resilient Sheet Flooring.  
.1 Marmoleum Walton Uni, 171 Cement, *Forbo* (2.5mm) .
- .17 SL Sealed Concrete: In accordance with Section 03 35 00 - Concrete Finishing.
- .18 SF **Safety Flooring**  
.1 Altro Classic 25, Graphite X2546R11, Altro.
- .19 ST Stone.  
.1 ST1 Ledgerock Algonquin Smooth SA16-178, 12"x24", 8mm thickness.

## 1.2 NOTES

1. All exposed edges of CT to be finished with Aluminum edge trim in accordance with Section 09 30 05.
2. All CT base joints to match floor tile and to be aligned with floor tile joints.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 05 41 00 - Structural Metal Stud Framing.
- .2 Section 06 10 11 - Rough Carpentry.
- .3 Section 07 84 10 - Comprehensive Firestopping.
- .4 Section 09 21 16 - Gypsum Board Assemblies.
- .5 Section 09 81 00 - Acoustic Insulation.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C645-11a. Standard Specification for Nonstructural Steel Framing Members.
  - .2 ASTM C754-11. Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

**1.03 DESIGN REQUIREMENTS**

- .1 Design complete framing system to obtain a maximum allowable deflection of L/360 with a horizontal Design load of 240Pa. Maximum Stud spacing 600 mm OC. Design system with lightest possible gauge studs including floor and ceiling tracks, anchors and related components. Design in accordance with manufacturer's published design guides to obtain a maximum deflection criteria in consideration of maximum framing height limits.
- .2 Stud Table.

| Stud Size<br>(mm) | Thickness<br>(mm) | Gauge (mm) | Gypsum Board                           |          |          |
|-------------------|-------------------|------------|----------------------------------------|----------|----------|
|                   |                   |            | 1 layer                                | 2 layers | 3 layers |
|                   |                   |            | Max vertical span unreinforced<br>(mm) |          |          |
| 41                | 0.46              | 25         | 2900                                   | 3200     | 2510     |
| 64                | 0.46              | 25         | 3810                                   | 4110     | 3350     |
| 64                | 0.84              | 20         | 4270                                   | 4500     | 3960     |
| 92                | 0.46              | 25         | 4880                                   | 5100     | 4420     |
| 92                | 0.84              | 20         | 5560                                   | 5760     | 5260     |
| 152               | 0.46              | 25         | 6090                                   | 6090     | 6090     |
| 152               | 0.84              | 20         | 8080                                   | 8380     | 7770     |

**1.04 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide Manufacturer's Product data sheets for each component.
- .3 Provide Shop Drawings. Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors. Indicate locations, dimensions, openings and requirements of related work.
- .4 Indicate thickness and profile for each component. Indicate deflection limit and design limit for each stud size and each gauge of stud used. Indicate maximum design height and stud spacing for each stud size and each gauge. Provide table indicating which stud size and gauge is used for each Wall Type as listed in the Drawings.
- .5 Provide Manufacturer's Design tables for all components. Indicate the construction for each wall assembly including: stud size, gauge, spacing, horizontal reinforcing, number and type of GWB panels applied to each face, type of cavity insulation, STC rating and Fire Resistance Rating.
- .6 Provide duplicate 300 mm long samples of each component. Provide samples in all specified thicknesses.

**1.05 QUALITY ASSURANCE**

- .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties. Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

**1.06 MOCK-UP**

- .1 Construct Mock-Up as specified in Section 01 45 00 - Quality Control.
- .2 Mock-Up to include a complete installation of a steel stud partition including the application of acoustic insulation, wall board, etc. Mock up to include the framing of a door opening.
- .3 Construct Mock up of curved wall assembly. Demonstrate curved track installation and attachment. Indicate installation of additional studs at locations to support ends and edges of flexible GWB panels in accordance with panel manufacturer's instructions.
- .4 Consultant will determine location of the Mock-Up.
- .5 Approved Mock-Up may remain part of the finished work.

**1.07 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate for disposal paper, plastic and corrugated cardboard packaging material in appropriate on-site containers for recycling in accordance with Waste Management Plan. Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Non-load bearing channel stud framing: to ASTM C645, 41, 64, 92 and 152 mm stud size. Roll formed from 0.84 mm minimum base steel thickness, (20 gauge) and from 0.46 mm minimum base steel thickness, (25 gauge) hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.
- .2 Heavy Gauge channel stud framing: to ASTM C645. Stud size 92 or 152 mm width as indicated in the drawings. Studs: 1.44 mm (16 gauge). Floor and ceiling track. 1.62 mm (15 gauge) with 50 mm flange height. Bridging channel: 1.44 (16 gauge) x 38 mm width. Bridging clips: 1.44 (16 gauge) x 38 mm legs x width to suit studs.
- .3 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.
- .4 Curving floor and ceiling tracks: segmented, sectional, commercial grade top and bottom track. Purpose made for construction of curved wall assemblies. C shaped components with integral locking mechanism in the bottom of the track to secure the individual segments together and lock in the shape of the curve. Complete with integral flexible side straps to allow for curvature indicated on drawings. Commercial steel sheet with ASTM A653, Z180, hot-dip galvanized zinc coating. Properties as follows:
  - .1 Width: to match stud width as indicated in the drawings. Flange height: 50 mm.
  - .2 Minimum base metal thickness: 1.44 mm (16 ga).
- .5 Metal channel stiffener: manufacturer's standard sizes, 1.4 mm minimum base steel thickness (16 Gauge) cold rolled steel, coated with rust inhibitive coating.
- .6 Solid Blocking. 38 mm thick lumber as specified in Section 06 10 11 - Rough Carpentry. Width of lumber to suit location and to be sufficient to allow complete attachment of item.
- .7 Plywood Blocking: 15 mm thick G1S DFP plywood as specified in Section 06 10 11 - Rough Carpentry.

**2.02 ACOUSTIC ACCESSORIES**

- .1 Isolation strip: rubberized, moisture resistant 6 mm thick black closed cell foam, 50 mm wide, with self adhesive on one face.
- .2 Acoustic Insulation: as specified in Section 09 81 00 - Acoustic Insulation.

**Part 3 Execution**

**3.01 ERECTION**

- .1 Install steel stud framing systems in accordance with ASTM C754 and manufacturer's written instructions.
- .2 Install Loadbearing heavy gauge steel stud framing systems as specified in Section 05 41 00 - Structural Metal Stud Framing.

**3.02 ACOUSTIC ISOLATION**

- .1 Install continuous row of isolation strip to separate steel stud partitions from fixed building surfaces.
- .2 Install isolation strip under floor tracks of all partitions. Install isolation strip as a continuous strip below all partitions. Install isolation strip vertically to separate partitions from fixed vertical

structural components of the building. Install isolation strip to separate top track from structure above when partitions extend full height.

### 3.03 STEEL STUD INSTALLATION

- .1 Install heavy gauge steel stud framing systems where indicated in the drawings. Install horizontal through the stud bridging channel continuously at maximum 1200 OC vertically to reinforce and stiffen the wall assembly horizontally and axially. Attach horizontal bridging channels to each stud with bridging clips.
- .2 Align partition tracks at floor and ceiling and secure at 600 mm OC maximum.
- .3 Extend partitions full height to structural slab above except where noted otherwise on drawings. Construct full height partitions tight to underside of structure above.
- .4 Construct partitions to finished acoustic ceiling heights where indicated in the drawings.
- .5 Place studs vertically at 600 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .6 Erection tolerances:
  - .1 Plumb: not to exceed 1/500th of member length.
  - .2 Camber: not to exceed 1/1000th of member length.
  - .3 Spacing: not more than 3.0 mm from design spacing.
  - .4 Gap between end of stud and track web: not more than 4.0 mm.
- .7 Attach studs to floor and ceiling track using screws.
- .8 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .9 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .10 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .11 Install heavy gauge single jamb studs at openings.
- .12 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .13 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .14 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks. Use double track slip joint as indicated.
- .16 Install curved wall assemblies using segmented top and bottom tracks. Lay out track to radiused curves as detailed and in accordance with track Manufacturer's written instructions. Lock track segments together and secure to building structure. Install screws in flanges of track to lock assembly. Co-ordinate installation with Section 09 21 16 - Gypsum Board Assemblies and install additional back to back steel studs at all ends and edges of flexible Gypsum Board Panels. Stagger butt joints in GWB panels a minimum of 2 stud spaces.

**3.04 BLOCKING**

- .1 Install Blocking in accordance with the Schedule in Section 06 10 11 - Rough Carpentry.
- .2 Install 38 mm thick solid wooden blocking secured between studs for attachment of handrails, washroom fixtures, behind lavatory basins, toilet and washroom accessories, kitchen cabinets, attached millwork, other fixtures including grab bars and towel rails and as indicated. Secure between studs through webs and through face flange of stud.
- .3 Install layer of 15 mm thick plywood between steel studs where indicated in the drawings and where required to allow for the future installation of surface mounted equipment and fixtures. Secure edges of plywood directly through edge of steel studs. Sizes of plywood blocking to fully support item and to be oversized to accommodate future adjustment of final location.

**3.05 ACOUSTIC INSULATION**

- .1 Install Acoustic insulation to steel stud partitions as specified in Section 09 81 00 - Acoustic Insulation. Completely fill stud cavity.

**3.06 FIRESTOPPING**

- .1 Co-ordinate installation of Steel Stud Partitions with Section 07 84 00 - Firestopping. Do not proceed with installation of partitions that would interfere with the Firestopping of penetrations through Fire Rated floor or wall assemblies.

**3.07 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.01 SUMMARY**

- .1 **Hygienic Wall Coverings.** Panels to be Class A Fire rated, stain resistant, impact resistant, providing an easy to clean, continuous surface. Integrated bacteriostat, not relying on topical coatings for protection. High Performance, hygienic wall covering system. Durable, watertight, impervious, seamless smooth wall system. Installed panels create a gapless system that eliminates any condition that permits bacterial or microorganism growth. System to be heat formable on site and compatible with Sheet Flooring as specified in Section 09 65 16 - Resilient Sheet Flooring. Provide overlap and welded seam to sheet flooring to eliminate gaps where bacteria growth is possible.

**1.02 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.
- .2 Section 09 65 16 - Resilient Sheet Flooring.
- .3 Section 10 26 10 - Corner Guards.

**1.03 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM D5420-16. Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
  - .2 ASTM E84-15b. Standard Test Method for Surface Burning Characteristics of Building Materials.

**1.04 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Manufacturers Product Data sheets on specified products. Describe physical and performance characteristics, sizes, patterns and colours available.
- .3 Submit Shop Drawings. Provide plans and room elevations. Indicate location of each panel. Indicate details at joint with flooring, top edge, interior corners, exterior corners. Indicate details for joints and seams, borders and patterns. Provide layout for each space listed in the Finish Schedule. Provide cross sections and technical descriptions of all accessories.
- .4 Submit Samples. Submit duplicate samples of each product in type and colour specified. Panel sample size: 300 x 300 mm. Submit 300 mm long sections of each accessory, trim, edge strips and transition strips.
- .5 Submit certified Manufacturer's Test Reports showing compliance with specified performance characteristics and physical properties.
- .6 Submit Manufacturer's installation instructions. Submit Manufacturer's special installation requirements including special procedures and perimeter conditions requiring special attention.
- .7 Submit Material Safety Data for wall panels and adhesives. Indicate VOC content.
- .8 Submit maintenance and repair instructions. Provide operation and maintenance data for installed products. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

**1.05 QUALITY ASSURANCE**

- .1 Installer Qualifications. Installer experienced in performing work of this section who has specialized in installation of specified panel system. Installer must be certified and trained by Manufacturer.
- .2 Construct Mock-Ups in accordance with Section 01 45 00 - Quality Control.
  - .1 Construct Mock-Up consisting of full height installation. Minimum length of wall section 3.0 m. Mock-Up to include one interior corner, one exterior corner, one joint with a door frame and include joint with flooring system.
  - .2 Allow 24 hours for inspection of Mock-Up by Consultant before proceeding with wall covering work.
  - .3 When accepted, Mock-Up will demonstrate minimum quality for workmanship for this work. Mock-up may remain as part of finished work.
- .3 Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

**1.06 DELIVERY, HANDLING AND STORAGE**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .3 Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.
- .4 Store panels in temperature controlled environments. Leave protective film on panel until ready to use. Store panels on a level flat surface.
- .5 Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.07 PROJECT CONDITIONS**

- .1 Temperature: maintain air temperature and structural base temperature at installation area between 20 and 26 degrees C and relative humidity below 40 % for 96 hours before, during installation and for a minimum of 72 hours after installation. Store panels on site for minimum of 48 hours prior to installation.
- .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities. Provide continuous ventilation during and after coating application.

**Part 2 Products**

**2.01 MATERIALS**

- .1 **Hygienic Wall Covering:** 100 % pure vinyl, extruded, semi-rigid PVCu sheet. U/V stabilized, containing no plasticizers or fillers. Homogenous sheet incorporating an internal bacteriostat to give the exposed surface excellent antibacterial activity and protection against fungal activity. Class A Fire rating to ASTM E84. By same manufacturer as Sheet Flooring as specified in Section 09 65 16 - Resilient Sheet Flooring. Properties as follows:
  - .1 Thickness: 2.5 mm.
  - .2 Dimensions: 1220 wide x 3000 mm high. Provide in full lengths only.



- .3 Density: 1.39 grams per cubic cm.
- .4 Impact resistance: to ASTM D5420. Greater than 160 in-pounds.
- .5 Flexural Strength: 178 MPa.
- .6 Tensile Strength: 48 MPa.
- .7 Shore D Hardness: 79.
- .8 Compressive Strength: 70 N/mm. (10000 psi).
- .9 Weight: 3.5 kg per square meter.
- .10 Maximum service Temperature: + 60 degrees C.
- .11 Surface texture: smooth face on one side and textured face on other side outer side.
- .12 Colours: multiple colours will be selected by Consultant from full and extended range of available colours.
- .13 Acceptable Product: Altro Whiterock.

## 2.02 ACCESSORIES

- .1 Welding rod - panels / panel: colour matched PVC rod by manufacturer of panel.
- .2 Welding rod - panel / flooring: colour matched PVC rod by manufacturer of panel. Compatible with flooring as specified in Section 09 65 16 - Resilient Sheet Flooring.
- .3 Joint tape: manufacturer's standard double sided tape. For supplementary support of panels at seams edges and corners prior to heat welding.
- .4 Adhesive: two component resin based polyurethane. Suitable for wet areas, non-climate controlled areas, and non-absorbent surfaces. As recommended by manufacturer.
- .5 Mastic: by manufacturer to suit locations and as required to complete the panel system.
- .6 Primer: polyvinyl acrylic (PVA) or as recommended by panel manufacturer.
- .7 Edge trim, start trim, joint strip, transition strips, cap strips: colour matched to panel. Manufacturers standard components as required for complete system to provide smooth seamless transition to adjacent wall, floor and ceiling surfaces. Provide in maximum lengths to eliminate joint seams.
- .8 Corner protector: stainless steel corner guards as specified in Section 10 26 10 - Corner Guards.
- .9 Sealant: single component, mildew resistant silicone caulking as specified in Section 07 92 10 - Joint Sealing.

## Part 3 Execution

### 3.01 MANUFACTURER'S INSTRUCTIONS

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

### 3.02 EXAMINATION

- .1 Verify substrate conditions installed under other sections. Confirm that existing conditions are acceptable for product installation in accordance with manufacturer's instructions.
- .2 Ensure walls are smooth, plumb and level. Remove high points and fill low points with high strength filler.

- .3 Verify that walls are flat. Inspect corners, window reveals, and door entrances to ensure they are free of any debris or irregularities, which could prevent the panels laying flat to the substrate after the adhesive has been applied and the panel installed.
- .4 Ensure surfaces are dry and free from all substances that may contribute to adhesive bond failure.
- .5 Remove loose paint and conduct an adhesive bond test.
- .6 Ensure exterior walls are adequately damp-proofed and insulated.

### 3.03 PREPARATION

- .1 Prepare surfaces according to covering manufacturer's instructions.
- .2 Work penetrating substrate to be completed before installing covering.
- .3 All surfaces must be free from dust and clean. Maintain a dust free working environment during installation. Ensure no air born particulates are in the work space that will reduce the bond strength between the adhesive and substrate.
- .4 Apply coat of primer to all substrate surfaces a minimum of 12 hours prior to the installation.
- .5 Verify that all electrical switches, receptacles are secure.
- .6 Ensure that all plumbing items protruding through the walls are secure. Neatly drill the panels and slide over the pipe tails. Drill all holes 3 mm oversize to allow for expansion, then seal with caulking.
- .7 Insulate hot pipes and steam pipes and maintain a 3 - 6 mm expansion gap at perimeter. Seal with caulking.
- .8 Maintain a 3 mm expansion gap around all pipes, fixing bolts, etc. extending through the panels. Seal with caulking.
- .9 Ensure that door and window frames and other wall openings are completed including all trim prior to installation of wall panels.
- .10 Prior to installation, complete any painting adjacent to wall panels.

### 3.04 INSTALLATION

- .1 Construct all joints as detailed in manufacturer's installation guide. No horizontal seams permitted.
- .2 Apply adhesive to substrate as recommended by manufacturer. Modify adhesive as required depending on room type and as per manufacturer's instructions.
- .3 Install wall panels before installation of plumbing fixtures, electrical equipment, bases and wall cabinets.
- .4 Install panels with smooth face of the panel exposed.
- .5 Leave protective film in place until all operations in the area are complete and the space is ready for final inspection and acceptance. Remove film only when directed by Consultant.
- .6 Remove excess adhesive along finished seams immediately after wall covering is applied. As work progresses ensure clean warm water is used for final rinsing of wall covering and leave clean.
- .7 Leave completed work smooth, clean, without wrinkles, gaps, overlaps or air pockets.
- .8 Extend panels to floor and overlap junction with Sheet Flooring as specified in Section 09 65 16 - Resilient Sheet Flooring. Adhere wall panels to flooring and apply bead of sealant in accordance with Manufacturers instruction to create integral, gapless, seamless joint.

- .9      Seams: apply double sided tape at vertical joints between panels. Leave gap between panels as recommended for hot welded seams. Heat weld seams in accordance with manufacturer's recommendations.
- .10     Edges: Install panels without applied trim at exposed edges. Trim edges straight and true and seal edge with bead of clear silicone sealant.
- .11     Corners: Construct thermoformed interior and exterior corners as recommended by manufacturer. Form joints at door and openings to create hair tight joints.
- .12     Return the panels at openings for doors or windows to the height indicated in the Drawings. Ensure a straight and clean edge at the junction with the surface of window sills or door jambs.

**3.05            CORNER PROTECTION**

- .1      Apply stainless steel corner guards at exposed external corners. Attach to panels in accordance with Manufacturer's written instructions. Guards to extend full height. Corner Guards as specified in Section 10 26 10 - Corner Guards.

**3.06            CLEANING**

- .1      Proceed in accordance with Section 01 74 11 - Cleaning.
- .2      Clean surfaces to covering manufacturer's written instructions.
- .3      Once all panels and joints are installed, remove protective film and clean all surfaces with antistatic solution or antistatic wipes.
- .4      Clean with a diluted soap/detergent solution.
- .5      Do not exceed the water temperature of 60 degrees C.
- .6      Apply non-abrasive, alkaline cleaner as recommended by Manufacturer for stubborn stains.

**3.07            PROTECTION**

- .1      Protect finished surfaces and exterior corners from damage until final inspection.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 06 10 11 - Rough Carpentry.
- .2 Section 09 72 00 - Hygienic Wall Coverings.

**1.02 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's printed product literature, specifications and Product Data Sheet.
- .3 Submit shop drawings. Indicate, physical dimensions, details, materials, finishes, dimensions, anchorage details.
- .4 Submit samples. Submit duplicate 300 mm long samples of profiles. Indicate finishes for stainless steel corner guards.
- .5 Submit manufacturer's installation instructions.

**1.03 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Metal corner guards: flush mounted 1.6 mm (16 gauge) thick, 89 x 89 mm size, 2438 mm high, with 6 mm radiused corners. Sharp 3.2 mm radius, 90 degree vertical corner. Continuous 6 mm wide vertical wing to ensure that guard sits tight to wall at vertical edges. Fabricate from Type 302 vertical brushed finish stainless steel, with removable protective paper cover. Mechanically fastened.
- .2 Predrill countersunk holes to accept number 8 fasteners. 75 mm from top and bottom edges and 350 mm OC vertically. Both sides.
- .3 Radius all exposed edges to eliminate rough and sharp edges.

**2.02 ACCESSORIES**

- .1 Fasteners: Number 8, taper head, self-tapping, stainless steel screws. Size and length to suit location and to penetrate steel studs.
- .2 Adhesive: water resistant construction adhesive as recommended by manufacturer for substrate.

**Part 3            Execution**

**3.01            MANUFACTURER'S INSTRUCTIONS**

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

**3.02            INSTALLATION**

- .1    Co-ordinate with Section 06 10 11 - Rough Carpentry and ensure that solid blocking is installed vertically and horizontally at all corners that are to receive corner guards.
- .2    Install over top of completed Hygienic Wall Cladding to protect all exposed exterior corners.
- .3    Install units on solid backing and erect with materials and components straight, plumb, tight to corner and in alignment.
- .4    Mechanically fasten corner guards to steel stud wall framing on both sides of guard.

**3.03            CLEANING**

- .1    Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2    Clean surfaces after installation using manufacturer's recommended cleaning procedures.

**END OF SECTION**

**Part 1 General**

**1.01 RELATED SECTIONS**

- .1 Section 07 92 10 - Joint Sealants.

**1.02 REFERENCES**

- .1 American Society for Testing and Materials (ASTM).
  - .1 ASTM A167-99(2009). Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM A653/A653M-11. Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3 ASTM F2285-04(2010). Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use.
- .2 Canadian Standards Association (CSA).
  - .1 CAN/CSA-B651-12. Accessible Design for the Built Environment.

**1.03 SUBMITTALS**

- .1 Provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Shop Drawings. Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars. Show anchorage, accessory and finishes.
- .3 Submit manufacturers Product Data sheets. Provide manufacturer's catalog cuts including hardware and fastenings. Submit manufacturer's installation instructions for each component.
- .4 Submit samples. Submit representative samples of each specified item, including mounting brackets, fastenings and trim. Reviewed samples will be returned for inclusion into the work.

**1.04 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.05 DELIVERY STORAGE AND HANDLING**

- .1 Deliver and store materials in manner to prevent damage and in accordance with manufacturers written instructions. Deliver pre-finished materials in original, unopened cartons or other packaging materials necessary to protect structure and finishes.
  - .1 Label packages clearly with manufacturer's name and item description.
  - .2 Store materials in original packaging until installation.
  - .3 Store components with adequate support to ensure flatness and to prevent damage to pre-finished surfaces.

**1.06 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**1.07 EXTRA MATERIALS**

- .1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories as specified in Section 01 78 00 - Closeout Submittals.
- .2 Deliver special tools to Consultant.

**Part 2 Products**

**2.01 MATERIALS**

- .1 Sheet steel: hot-dip galvanized steel to ASTM A653/A653M with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A167, 18-8, Type 304 with brushed finish. Apply manufacturer's proprietary finish to minimize visual markings and appearance of fingerprints.
- .3 Stainless steel tubing: Type 304 commercial grade, seamless welded. Wall thickness as specified for each component.
- .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.
- .5 Hollow wall anchors are not permitted. All items to be secured to studs or solid blocking as specified in Section 06 10 11 - Rough Carpentry.
- .6 Fasteners: theft resistant, stainless steel, one way or pin head torx screws. Factory installed threaded inserts.

**2.02 COMPONENTS**

**SPEC NOTE: LIST OF ITEMS TO BE REVIEWED. THE FOLLOWING IS A REPRESENTATIVE LIST OF ITEMS.**

- .1 **ITEM XX:** Semi-Recessed napkin / tampon vendor. Combine two dispensing mechanisms in one cabinet to provide sanitary napkins or tampons at user's option. Mechanical operations; no batteries or electricity required. Pre-set dispensing mechanism at factory for \$0.50 operation. Convertible in the field to allow the change of coin denomination without removing unit from wall. Furnish door with graphics indicating specified coin denomination. Fabricate from type-304 stainless steel with all-welded construction; exposed surfaces number 4 satin finish. Provide Stainless steel skirt with satin finish and 90° return on edges. Provide radius on corners to complement corners and edges of flange and door. Fabricate door front with same degree of arc to match other washroom accessories. Provide matching radius on corners and edges of flange, skirt and door to match other washroom accessories. Fabricate flange as drawn, one piece, seamless construction. Fabricate door as drawn, 1.2 mm, one-piece, seamless construction. Secure door to cabinet with a full-length stainless steel piano-hinge; and equipped with a stainless steel cable door-swing limiter and two flush tumbler locks keyed to match other washroom accessories. Provide product selection and coin return pushbutton-operation certified ADA complaint by third party for operation with one hand with less than 22.2 N of force without tight grasping, pinching or twisting of the wrist. Push-Button coin return shall cancel selection and return coin into product tray. Wrong coins (penny, nickel, dime) shall by-pass mechanisms and drop into product tray. Fabricate product tray from impact resistant PC-ABS plastic and provide easy access to dispensed product. Equip coin box with a tumbler lock that is keyed differently than door locks. No brand name advertising. Face Dimensions: approx. 725 mm high x 370 mm wide. Rough opening: 320 mm wide x 670 mm high x minimum 100 mm deep.

- .1 Standard of Acceptance: Bobrick B-3706 50.
- .2 **ITEM XX:** Small recessed paper towel dispenser and waste receptacle: Combination folded paper towel dispenser/waste receptacle. Fully recessed, wall mounted unit. Fabricate from type-304 stainless steel with all-welded construction. Exposed surfaces satin finish. Fabricate flange as drawn, one-piece, seamless construction. Fabricate door from 1.2 mm thick Stainless Steel with 14 mm, 90° return edges. Secure door to cabinet with a concealed, full-length stainless steel piano-hinge and equipped with a stainless steel cable door-swing limiter and friction catch. Fabricate door to conceal flange from view. Capacity of 300 C-fold or 400 multifold paper towels without adjustment or use of adapters. Furnish receptacle with a removable, leak proof, rigid molded plastic waste container with a capacity of 6.1L. Approximately 330 mm wide x 790 mm high x 90 mm deep, fully recessed into wall. Rough opening 290 mm wide x 750 mm high x minimum 95 mm deep.
  - .1 Standard of Acceptance: Bobrick B-36903.
- .3 **ITEM XX:** Surface mounted paper towel dispenser and waste receptacle: Combination folded paper towel dispenser/waste receptacle. Wall mounted unit. Fabricate from type-304 stainless steel with all-welded construction. Exposed surfaces satin finish. Fabricate skirt from 0.8 mm stainless steel. Fabricate door from 1.2 mm thick Stainless Steel with 14 mm, 90° return edges. Secure door to cabinet with a concealed, full-length stainless steel piano-hinge and equipped with a stainless steel cable door-swing limiter and 2 tumbler locks keyed to match other washroom accessories. Fabricate door to conceal flange from view. Capacity of 600 C-fold or 800 multifold paper towels without adjustment or use of adapters. Furnish receptacle with a removable, leak proof, rigid molded plastic waste container with a capacity of 14.4 L. Approximately 330 mm wide x 1400 mm high x 117 mm projection from face of wall.
  - .1 Standard of Acceptance: Bobrick B-3803 49.
- .4 **ITEM XX:** Recessed paper towel dispenser and waste receptacle: Combination folded paper towel dispenser/waste receptacle. Fully recessed, wall mounted unit. Fabricate from type-304 stainless steel with all-welded construction. Exposed surfaces satin finish. Fabricate door from 1.2 mm thick Stainless Steel with 14 mm, 90° return edges. Secure door to cabinet with a concealed, full-length stainless steel piano-hinge and equipped with a stainless steel cable door-swing limiter and 2 tumbler locks keyed to match other washroom accessories. Fabricate door to conceal flange from view. Capacity of 600 C-fold, 800 multifold or 1100 single fold paper towels without adjustment or use of adapters. Furnish receptacle with a removable, leak proof, rigid molded plastic waste container with a capacity of 24.0 L. Approximately 330 mm wide x 1400 mm high x 142 mm deep, fully recessed into wall. Rough opening 292 mm wide x 1362 mm high x minimum 146 mm deep.
  - .1 Standard of Acceptance: Bobrick B-3803.
- .5 **ITEM XX:** Surface mounted waste receptacle with bin liner holder: Receptacle to be 18-8, type 304, 20 gauge (1mm) stainless steel, all welded construction, satin finish on all visible parts. Front of receptacle to have a slight radius in plan. Top edge hemmed, & bottom with recessed finger grip. Reinforcement straps on back of unit for strength to the mounting screws holes (4 minimum). Capacity to be 12.75 cal. (48.3L). Equipped with bin liner holder to ease installation & removal of disposable bin liner and retains liners inside waste receptacle. Liner holder to be moulded plastic sleeve with a 20 gauge (1mm) stainless steel u-shaped support hemmed for safety, riveted construction. Liner holder will rest inside waste receptacle area, and have an arc at front and same shape as inside of waste receptacle area.
  - .1 Standard of Acceptance: Bobrick B-277.
- .6 **ITEM XX:** Recessed waste receptacle with bin liner holder cabinet: Cabinet to be 18-8, type 304, 22 gauge (0.8mm) stainless steel, formed of one piece seamless construction, satin finish on all visible parts. Flange to be of similar specifications, drawn, one-piece, seamless construction, with radius on corners and return edges of waste receptacle. Waste receptacle



to be 18-8, type 304, 22 gauge (0.8mm) stainless steel, formed of one piece seamless construction, satin finish on all visible parts. Removable front of receptacle to have a slight radius in plan. Top edge hemmed for safety. Receptacle to be secured to cabinet by two keyholes over studs on bottom & two tamper resistant setscrews on tops. Capacity 12.8 gal. (48.3L). Reinforcement straps on back of unit for strength to the mounting screws holes (4 minimum). Capacity to be 12.75 cal. (48.3L). Equipped with bin liner holder to ease installation & removal of disposable bin liner and retains liners inside waste receptacle. Liner holder to be moulded plastic sleeve with a 20 gauge (1mm) stainless steel u-shaped support hemmed for safety, riveted construction. Liner holder will rest inside waste receptacle area, and have an arc at front and same shape as inside of waste receptacle area.

- .1 Standard of Acceptance: Bobrick B-43644.

.7 **ITEM XX.** Surface Mounted Automatic Hand Dryer: Warm air, rapid drying, high efficiency, self-contained electric hand dryer. Hand drying shall be accomplished in two sequential phases:

- .1 Phase 1: Loose water droplets blown from hands with strong, controlled air blast: at outlet: 19,000 LFM. Approximate time: 3 to 4 seconds. Water removed: 75 percent.
- .2 Phase 2: Residual moisture evaporated and hands warmed by heated air stream. Minimum air temperature at average hand position of 102 mm below air outlet: 58 degrees C when room temperature is 20 degrees C. Water removed: 25 percent. Total drying time required to remove 5 to 6 grams of water: Varies depending on conditions from 10 to 15 seconds. Maximum moisture remaining on hands at end of drying cycle: 0.2 grams.
- .3 Hand dryers certified by Underwriters Laboratory UL and CSA.
- .4 Nominal size: 241 mm wide by 279 mm high by 172 mm deep. Weight: 5.0 kg.
- .5 Power requirements: 1450 watts. 12.6 amps @120V. 6.3 amps @230V.
- .6 Combination blower and motor: Series commutated, through-flow discharge, vacuum type powered by 5/8 HP, 20,000 RPM motor.
- .7 Air heater: 900 watts. Located following blower and capable of heating air stream. Protect with automatic resetting thermostat to open when air flow is restricted and close when air flow is resumed.
- .8 Air outlet: designed to focus air stream, enhance force, and deliver warm air at average hand position of 102 mm below outlet.
- .9 Electronic controls: solid state, infrared, self-calibrating sensor automatically turns dryer on when hands are held under air outlet. Removal of hands causes dryer to stop within 2 seconds. Electronic sensor shuts off dryer after 35 seconds if hands are not removed or inanimate object is placed across air outlet. Bi-metallic temperature limiting auto reset breaker.
- .10 Cover: One piece, 1.5 mm thick stainless steel. Finish: brushed stainless steel. Secure cover to wall plate with tamperproof screws.
- .11 Wall plate: injected molded, rib reinforced plate with metal L brackets for attaching cover. Provide plate with ten 8 mm diameter holes for surface mounting to wall and two 22 mm diameter holes for electrical wiring.
- .12 Standard of Acceptance: BLAST by Comac.

.8 **ITEM XX.** Surface Mounted Seat-Cover and Toilet Tissue Dispenser (men's). Fabricated from heavy-gauge 18-8 type 304 stainless steel, exposed surfaces satin finish. Flanges to be 22 gauge (0.8 mm) , drawn & beveled, one piece, seamless construction. Doors to be 18 gauge (1.2 mm), one piece, seamless construction, full length stainless steel piano hinge. Two tumbler locks keyed like other washroom accessories. Toilet Tissue Dispensers (2): 2.5 mm thick ABS, with theft-resistant heavy-duty, one piece moulded ABS spindles. Spindles

removable from unit only when door is open. Unit to hold two standard-core toilet tissue rolls 135mm diameter. Toilet seat dispenser to hold 500 single or half-fold paper covers. Toilet tissue dispensers on the right side, door hinged on the left.

- .1 Standard of Acceptance: Bobrick Surface-Mounted Seat-Cover and Toilet Tissue Dispenser. Product number B-3479.
- .9 **ITEM XX.** Recessed Seat-Cover and Toilet Tissue Dispenser (men's). Same as item 9a, but recessed into wall instead of surface mounted. Toilet tissue dispensers on the left side, toilet tissue dispenser door hinged on the right.
  - .1 Standard of Acceptance: Bobrick Surface-Mounted Seat-Cover and Toilet Tissue Dispenser. Product number B-34745.
- .10 **ITEM XX.** Recessed Seat-Cover and Toilet Tissue Dispenser (men's). Same as item 9b but inverted. Toilet tissue dispensers on the right side, toilet tissue dispenser door hinged on the left.
  - .1 Standard of Acceptance: Bobrick Surface-Mounted Seat-Cover and Toilet Tissue Dispenser. Product number B-3474.
- .11 **ITEM XX.** Surface Mounted Seat-Cover and Toilet Tissue Dispenser, and Sanitary Napkin Disposal (women's). Fabricated from heavy-gauge 18-8 type 304 stainless steel, exposed surfaces satin finish. Flanges to be 22 gauge (0.8 mm) , drawn & beveled, one piece, seamless construction. Doors to be 18 gauge (1.2 mm), one piece, seamless construction, full length stainless steel piano hinge. Two tumbler locks keyed like other washroom accessories. Toilet Tissue Dispensers (2): 2.5 mm thick ABS, with theft-resistant heavy-duty, one piece moulded ABS spindles. Spindles removable from unit only when door is open. Unit to hold two standard-core toilet tissue rolls 135mm diameter. Toilet seat dispenser to hold 500 single or half-fold paper covers. Disposal Panel to be 18-8 type 22 gauge (0.8mm) with hemmed edges, secured to door with spring loaded full length stainless steel piano hinge, showing an international graphic symbol identifying napkin disposal. Leak-proof moulded polyethylene waste receptacle (0.8 gal.), removable for servicing. Toilet tissue dispensers on the right side, door hinged on the left.
  - .1 Standard of Acceptance: Bobrick Surface-Mounted Seat-Cover Dispenser, Toilet Tissue Dispenser & Sanitary Napkin Disposal. Product number B-3579.
- .12 **ITEM XX.** Recessed Seat-Cover and Toilet Tissue Dispenser, and Sanitary Napkin Disposal (women's). Same as item 9d, but recessed into wall instead of surface mounted. Toilet tissue dispensers on the left side, toilet tissue dispenser door hinged on the right.
  - .1 Standard of Acceptance: Bobrick Surface-Mounted Seat-Cover and Toilet Tissue Dispenser. Product number B-35745.
- .13 **ITEM XX.** Recessed Seat-Cover and Toilet Tissue Dispenser, and Sanitary Napkin Disposal (women's). Same as item 9e but inverted. Toilet tissue dispensers on the right side, toilet tissue dispenser door hinged on the left.
  - .1 Standard of Acceptance: Bobrick Surface-Mounted Seat-Cover and Toilet Tissue Dispenser. Product number B-3574.
- .14 **ITEM XX.** Horizontal Recessed Mounted, Stainless Steel Baby Changing Station. Fabricated from FDA approved, blow molded high density polyethylene (HDPE) clad in 1.2 mm Type 304 stainless steel with brushed finish. Provide stainless steel flange with brushed finish. Operation: Concealed pneumatic cylinder providing controlled, slow opening and closing of the changing station bed. Hinge Mechanism: Reinforced full length steel on steel hinge with integrated hook plate. Changing Surface: Contoured, concave and smooth, 2851 square cm. Provide Stainless Steel liquid diversion channel to prevent liquids that may be present on the changing surface from draining into the wall. Provide replaceable, snap lock, nylon protective safety straps. Performance: Units exceed static load requirements as per ASTM F2285.

Manufacturer provided mounting hardware and 11 gauge steel mounting brackets. Features: No hinge structure exposed on interior or exterior surfaces. Provide two bag hooks, built in liner dispenser with 25 liner capacity. Provide Universal molded instruction graphics and safety messages in multiple languages. Size 940 mm wide x 584 mm high. Rough opening: 902 mm wide x 521 mm high x 108 mm minimum deep.

- .1 Standard of Acceptance: Bobrick KB110-SSRE.

- .15 **ITEM XX.** Surface Mounted Soap Dispenser. Traditional Box Stainless Steel 1 liter dispenser. Dispenser to accept pre-packaged refill cartridges including foamed soaps, liquid soaps, creams and sanitizers. Fabricate dispenser tank from type 304 stainless steel with all welded construction. Exposed surfaces: satin finish. Fabricate tank as one piece integral unit. Provide a top mounted tumbler lock to secure access door and key to match other washroom accessories. No exposed fastening devices. Provide a tamper resistant sight gauge indicator window on the front of the box. Provide a black nylon pump actuator operable with one hand. Capacity: 1.0 liter. Size: 130 mm wide x 240 mm high x 110 mm projection from face of wall. Dispenser to accept prepackaged refill cartridges as provided by Building Owner.

- .1 Custom stainless steel soap dispenser from DebCanada SSD1LDS.

- .16 **ITEM XX,XX,XX,XX.** Grab bars: Fabricate from type 304 stainless steel tubing with satin finish. Peened, non-slip texture. 38 mm outer diameter x 1.2 mm wall thickness. Clearance between the grab bar and wall 38 mm. Provide concealed mounting flanges 50 x 80 mm x 3 mm thick stainless steel plate equipped with screw holes for attachment to wall. Provide 85 mm diameter x 0.8 mm thick x 13 mm deep flange covers. Cover to snap over mounting flange to conceal mounting screws and fasteners. Ends of grab bar shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Grab bar to comply with CSA B651 accessibility guidelines for structural strength. Grab bar material and anchorage to withstand downward pull of 2.2 kN. Provide straight bars to lengths as indicated in the drawings.

- .1 **XX.** Length 610 mm straight bar.

- .1 Standard of Acceptance: Bobrick B-6806.99x24.

- .2 **XX.** Length 915 mm straight bar.

- .1 Standard of Acceptance: Bobrick B-6806.99x36.

- .3 **XX.** Length 1065 mm straight bar.

- .1 Standard of Acceptance: Bobrick B-6806.99x42.

- .4 **XX.** Length ~~965mm straight bar~~, Wall and floor anchored.

- .1 Standard of Acceptance: ASI Type 15 Wall to floor grab bar. Custom size: 1260 projection from wall x 915 mm tall.

- .17 **ITEM XX.** Wall Hook. Commercial hook, fabricated from type 304 stainless steel with satin finish. 19 mm diameter solid stainless steel post with 6.4 mm diameter solid stainless steel hook pin. Machine post and mounting flange as a single piece. Provide concealed mounting flange fabricated from 5.6 mm thick stainless steel plate x 46 mm diameter and equipped with two screw holes for attachment. Provide thread on outside edge of mounting flange to fasten cover. Provide threaded flange cover fabricated from 1.4 mm stainless steel x 49 mm diameter to fasten over mounting flange to conceal mounting screws. Size: 49 mm overall diameter x 33 mm projection from wall.

- .1 Standard of Acceptance: Bobrick B-542.

- .18 **ITEM XX.** Folding Shower / Dressing Bench. Wall mounted, folding shower seat. Fabricate frame from 18-8, type 304, satin finish stainless steel that consists of 1.6 mm thick, 30 mm square tubing and 1.2 mm thick, 25 mm diameter seamless tubing. Fabricate seat from one piece of 8 mm thick, solidly fused plastic laminate with matte-finish melamine surfaces. Ivory colored face sheets, and black phenolic resin core. Provide seat with slots for water drainage.

Secure seat to frame with stainless steel carriage bolts and acorn nuts. Equip shower seat with two 75 mm diameter mounting flanges constructed of type 304, 5 mm thick, satin finish stainless steel. Provide a guide bracket constructed of type 304, 1.6 mm thick satin finish stainless steel and a spring constructed of 17-7, type 301 stainless steel, 0.6 mm thick that is spot welded to a baseplate of type 304 heavy gauge stainless steel. Seat shall be able to lock in upright position when not in use. Shower seat shall comply with CSA B651 barrier free accessibility guidelines. Overall size: 455 mm wide x 400 out from face of wall in lowered position.

.1 Standard of Acceptance: Bobrick. B5191.

- .19 **ITEM XX.** Folding Shower / Dressing Bench Special Area. Wall mounted, folding shower seat. Fabricate seat frame from 1.2 mm thick, 30 mm square tubing 18-8, type 304, satin finish stainless steel. Fabricate support components from 1.2 mm thick, 25 mm diameter stainless steel seamless tubing. Fabricate seat from first grade Teak slats, 12.5 mm thick x 35 mm wide. Secure seat to frame with countersunk, marine grade, stainless steel screws. Fabricate wall flanges from heavy gauge stainless steel. Provide constant friction wall mounted brackets that guide the U shaped legs freely up and down. Provide a low pressure constant spring action to raise and lower the seat. Lock seat in raised position when not in use with a positive stop friction spring guide bracket. Maximum weight capacity: 158 kg. Shower seat shall comply with CSA B651 barrier free accessibility guidelines. Overall size: 556 mm wide x 380 out from face of wall in lowered position.

.1 Standard of Acceptance: MTI Baths Inc. Teak Shower Seat 22x15.

- .20 **ITEM XX.** Rectangular mirror with Stainless Steel Frame. Commercial construction, wall mounted mirror with stainless steel angle frame. Fabricate frame from 18-8, type 304, 19 mm x 19 mm, heavy gauge stainless steel angles with vertical grain satin finish. One piece, roll formed construction forms continuous integral stiffener. Bevel design on front of angle holds frame tightly against mirror. Frame corners heliarc welded, ground smooth and polished. Fabricate back from galvanized steel and fasten to frame with concealed screws. Provide integral horizontal hanging brackets near top and bottom of mirror to allow fastening to the wall and prevent mirror from pulling away from the wall. Provide 0.9 mm thick galvanized steel concealed wall hanger and locking screws to securely fasten mirror to hanger. Provide no. 1 quality, 6 mm thick select float glass, selected for silvering. Electrolytically copper plated by the galvanic process. 15 year guarantee against silver spoilage. Protect all glass edges with plastic filler strips and protect back of glass with full size layer of shock absorbing, water resistant, non-abrasive, 5 mm thick polyethylene padding.

.1 Standard of Acceptance: Bobrick. B-290 series. 1836.

- .21 **ITEM XX.** Heavy Duty Shower Rod. 25 mm diameter x 1.0 mm wall thickness fabricated from 18-8, type 304 stainless steel tubing with satin finish. Provide bars of required length. Fabricate finished flanges, 35 mm diameter, chrome plated plastic with bright polished finish. Provide concealed aluminum mounting brackets. Provide 12 shower curtain hooks. Shower rod material and anchorage to withstand downward pull of 0.9 kN. Shower curtain: 0.2 mm thick opaque, anti-bacterial fire resistive self-extinguishing vinyl laminated fabric shower curtain. Provide curtain hold-back hook and chain at each curtain. Provide nickel plated brass grommets along top. Bottom and side edges hemmed.

.1 Standard of Acceptance: Bobrick. B-207 series.

- .22 **ITEM XX.** Surface Mounted Paper Towel Dispenser. Fabricate from 0.8 mm thick, Type 304 stainless steel with all welded construction. Finish exposed surfaces with satin finish. Secure door to cabinet with a full length stainless steel piano hinge. Provide a tumbler lock keyed to match other washroom accessories. Provide hemmed opening on paper towel tray to dispense paper towels without tearing. Capable of dispensing 200 C-fold or 275 multifold paper towel measuring 79 to 97 mm deep. Design unit to accept narrower paper towels from

65 to 79 mm deep with the use of an optional accessory. Design unit to dispense paper towels one at a time without bulging, sagging or falling through the towel tray opening. Overall size: 275 mm wide x 180 mm high. Projection: 100 mm from face of wall.

- .1 Standard of Acceptance: Bobrick. B-26212.

## **2.03 FABRICATION**

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints. Brake form sheet metal work with 1.5 mm radius bends. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .3 Back paint components where contact is made with building finishes to prevent electrolysis.
- .4 Hot dip galvanize concealed ferrous metal anchors and fastening devices.
- .5 Shop assemble components and package complete with anchors and fittings.
- .6 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts. Provide steel anchor plates and components for installation on studding and building framing.
- .7 Manufacturers or brand names on face of units is not acceptable.

## **Part 3 Execution**

### **3.01 PREPARATION**

- .1 Review extent of blocking installed at rough framing stage to ensure that all wall mounted items have adequate and complete support. Ensure blocking is extensive to allow repositioning of items as required during installation. Allow repositioning a minimum of 300 mm in all directions from locations indicated in the drawings.

### **3.02 INSTALLATION**

- .1 Ensure supplementary anchorage, if required, is in place.
- .2 Comply with manufacturer's written data, including product technical bulletins, installation instructions, carton installation instructions, and datasheet. Manufacturer's recommendations will be considered as minimal instructions.
- .3 Install and secure accessories rigidly in place as follows:
  - .1 Stud walls: install solid blocking or plywood sheathing to stud assemblies prior to application of Gypsum board finish.
  - .2 Hollow masonry units: use toggle bolts drilled into cell/wall cavity.
  - .3 Solid masonry, marble, stone or concrete: use bolt with expansion sleeve set into drilled hole.
- .4 Install grab bars on built-in anchors provided by bar manufacturer. Provide solid wood blocking between studs at all grab bar location in hollow wall types.
- .5 Use tamper proof screws/bolts for fasteners.
- .6 Fill units with necessary supplies shortly before final acceptance of building.
- .7 Install unframed mirrors as specified in with Section 08 80 51 – Glass and Glazing.

**3.03 SCHEDULE**

- .1 Locate accessories where indicated on documents.
- .2 Where mounting heights are not indicated on the drawings, mount at heights as recommended by manufacturer. Where barrier free washrooms are provided **and mounting heights are not indicated on the drawings**, mount fixtures and accessories at heights as required by CSA-B651.
- .3 Wall Hooks. Install hooks in all toilet stalls mounted on back of door. Install hooks at 1200 mm above finished floor level.

**3.04 CLEANING AND ADJUSTING**

- .1 Clean exposed surfaces including hardware and fittings. Leave components clean and free from defects in workmanship.
- .2 Thoroughly adjust each component for proper operation after installation. Lubricate hardware and other moving parts.

**END OF SECTION**

**PART 1 General**

**1.01 RELATED SECTIONS**

- .1 Division 26 - Electrical.

**1.02 SYSTEM DESCRIPTION**

- .1 Design and installation of hands free, fall restraint systems. System to accommodate a maximum of 2 workers. System to include end anchors, corner anchors and intermediate supports with integral shock absorber on the fixed cable.
- .2 Lifeline system to be designed for installation to roof and parapets. Monorail system be designed for installation to soffit.
- .3 Provision of stainless steel air terminals to all exterior components of system.

**1.03 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A123/A123M-15. Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A240/A240M-14. Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .3 ASTM A269/A269M-15a. Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .4 ASTM B221-14. Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA-G40.20-13/G40.21-13. General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
  - .2 CAN/CSA-S157-05/S157.1-05 (R2010). Strength Design in Aluminum / Commentary on CSA S157-05. Strength Design in Aluminum.
  - .3 CSA-W47.2-11(R2015). Certification of Companies for Fusion Welding of Aluminum.
  - .4 CSA-W59-13. Welded Steel Construction (Metal Arc Welding).
  - .5 CSA-W59.2-M1991 (R2013). Welded Aluminum Construction.
  - .6 CAN/CSA-Z91-02 (R2013). Health and Safety Code for Suspended Equipment Operations.
  - .7 CSA Z259.13-16. Manufactured Horizontal Lifeline Systems.
  - .8 CAN/CSA-Z259-16-15. Design of Active Fall Protection System.
- .3 Province of Ontario
  - .1 Ontario Occupational Health and Safety Act Window Cleaning Regulation 859/90 as amended by 523/92, and 213/91 as amended by 631/94 (Construction Projects).

**1.04 DESIGN REQUIREMENTS**

- .1 Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the Province of Ontario.

- .2 Design complete system to requirements of CSA-Z259.13 CSA-Z259.16 and CAN/CSA-Z91.
- .3 Design complete system to conform to the Ontario Building Code. Design system to provide complete coverage to building exterior where any portion of the roof is more than 8.0 m above adjacent ground level.
- .4 Design complete system to provide coverage for both suspended maintenance and window cleaning operations. Ensure compatibility with industry standard equipment.
- .5 Design complete system in accordance with Ontario Occupational Health and Safety Act Window Cleaning Regulation 859/90 as amended by 523/92, and 213/91 as amended by 631/94 (Construction Projects).
- .6 Design complete system to provide for safe execution of maintenance operations including travel restraint and fall arrest.
- .7 Locate anchorage points to suit equipment that will be used to carry out maintenance operations with respect to criteria such as reach and roof edge conditions.
- .8 Design all anchor components to provide adequate structural attachment to the building. Ensure all anchor components conform to proper engineering principles and have been designed by a Professional Engineer qualified in the design of fall protection equipment.
- .9 Design anchors and equipment supports to comply with the following structural requirements:
  - .1 Fall Arrest Safety Anchors: design to a maximum fall arresting force of 8.0 kN (1800 lbs.) when wearing a body harness. Utilize a safety factor of 2. Design all components to accommodate design loads without any permanent deformation and to accommodate 22.24 kN (5000 lbs.) against fracture or detachment.

#### 1.05 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data sheets for all standard components.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets.
- .4 Submit shop drawings:
  - .1 Indicate complete layout and configuration of each system.
  - .2 Include layout and details of all components and accessories.
  - .3 Indicate design and fabrication details, hardware, and installation details.
  - .4 Indicate component profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
  - .5 Include erection drawings, elevations, and details.
  - .6 Indicate welded connections using standard welding symbols include net weld lengths.
  - .7 Include installation and rigging instructions and all necessary Restrictive and Non-Restrictive Working Usage Notes and General Safety Notes.
  - .8 Provide Shop Drawings stamped by a Professional Structural Engineer experienced in design of this Work and licensed in the Province of Ontario.
- .5 Submit design data. Submit Test Reports and substantiating engineering data and test results of previous tests by independent laboratory which purport to meet performance criteria, and other supportive data.
- .6 Provide samples. Submit duplicate full size samples of each component in specified finish. Reviewed samples will be returned for inclusion in the work.



- .7 Closeout Submittals: Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .1 Submit 1 copy of system Equipment Manual & Inspection Log Book, with "Initial Inspection - Certification for Use". Submit "Inspection Sign-Off" forms completed.
  - .2 Submit 2 copies of a reduced plastic laminated as-built shop drawing showing equipment locations and details. Post these drawings near exits onto the roof as directed by Consultant.

## **1.06 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications: manufacturer specializing in the design, fabrication and installation of fall restraint systems having a minimum of 5 years documented experience. Provide documentation to the approval of Consultant that the Manufacturer has completed projects of similar size and complexity.
- .2 Furnish welders' qualifications to Consultant. Employ qualified and licensed welders possessing certificates for each procedure to be performed from authority having jurisdiction. Certification of companies for fusion welding of steel structures to be in accordance with CSA-W59 and CSA-W47.2.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.
- .4 Co-ordinate the Work with installation of roofing assembly and sheet metal work.

## **1.07 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **PART 2 Products**

### **2.01 MATERIALS**

- .1 Acceptable Manufacturer: Pro-Bel.
- .2 Materials.
  - .1 Stainless steel plate: to ASTM A240/A240M.
  - .2 Stainless steel: to ASTM A269, 300 Series, Type 304 (18/8). Austenitic chromium-nickel alloy, commercial grade. Yield Strength 240 MPa. Seamless welded with AISI No. 5 satin finish.
  - .3 Steel sections, HSS, plates and bolts: Mild steel to CSA-G40.20M/G40.21. Type 300W with yield strength of 350 MPa and 300 MPa.
  - .4 Aluminum: to ASTM B221. Type 6061-T6 alloy.
  - .5 Bolts, nuts, and washers for stainless steel: stainless steel, matte finish.
  - .6 Welding materials: CSA-W59 for materials being welded.
- .3 Finishes:
  - .1 Galvanized after fabrication: Hot dipped galvanizing with zinc coating: Thickness 600g/m<sup>2</sup> to ASTM A123.

## 2.02 COMPONENTS - HORIZONTAL LIFELINE SYSTEM - HANDSFREE

- .1 Roof support: HSS shapes. Mild steel Type 300W, yield strength 350 MPa. Wall thickness to suit design application. Hot dipped galvanized after fabrication to ASTM A123. Height as indicated. Weld post to base plate. Provide end units, corner units and middle units as required.
- .2 Wall support: HSS shapes. Mild steel 350 MPa. Wall thickness to suit design application. Hot dipped galvanized after fabrication to ASTM A123. Sizes as indicated. Weld post to base plate. Provide end units, corner units and middle units as required.
- .3 Base plate, back plate, steel sections: mild steel 300 MPa. Size, thickness and securement to suit design application. Hot dipped galvanized after fabrication to ASTM A123.
- .4 Standard Intermediate support brackets: multi position Type 316 stainless steel with reinforcing end caps and suitable for installation at any height. Secured using 13 mm dia. fasteners.
- .5 Corner units: manufacturers standard 90 degree or 135 degree flexible corner units as required.
- .6 Securement bolts: mild steel, Type 300W with yield strength of 300 MPa (44 Ksi), hot dipped galvanized to ASTM A123.
- .7 Bolts: stainless steel bolts complete with stainless steel lock washers and hex nuts.
- .8 Safety U-bars: stainless steel. Type 304 stainless steel with yield strength of 240 MPa (35 Ksi). Minimum 19 mm diameter with 38 mm eye opening.
- .9 Safety support: 8 mm diameter stainless steel bolt for attachment of hands free cable support brackets.
- .10 Flashing: seamless spun aluminum. Type 6061-T6 alloy to ASTM B221. Prefabricated shape with deck flange. Provide formable mastic tape and heat shrink rubber collar to seal flashing to roof or wall supports.
- .11 Miscellaneous bolts, nuts and washers: stainless steel. Type 304 stainless steel with yield strength of 240 MPa (35 Ksi).
- .12 Cable: 8 mm diameter, Type 316 stainless steel with minimum breaking strength of 85 kN (19125 pounds), complete with swageless cable ends.
- .13 Capacity / data plate: provide systems with prominently displayed, non-corrosive plate clearly stating: Maximum Service Capacity, Maximum number of users, Manufacturer's name, Serial number and Manufacturing Date.
- .14 End terminal hardware: stainless steel swageless termination at one end and stainless steel tensioner with shock absorber at other end.
- .15 Lanyard cable runner: Type 316 stainless steel with automatic runner bypass for continuous "hands-free" operation that can be inserted or removed anywhere on the cable.
- .16 Harness: manufacturer's standard full body harness and lanyard complete with shock absorber.
- .17 Tensioner: steel turnbuckle, same material as cable.
- .18 Air terminal: constructed of copper or aluminum. With connection point to building lightning arrest system.

## 2.03 COMPONENTS - MONORAIL RAIL SYSTEM HANDSFREE

- .1 Monorails and mounting: designed to carry minimum vertical service load of 4.5 kN (1,000 lbs). Fabricate from aluminum extrusions designed to CAN/CSA-S157 and in accordance with

CSA-W59.2. Yield strength of 350 MPa (50 Ksi) and tensile strength of 450 MPa (65 Ksi).  
Monorail finish: clear anodized.

- .2 Capacity / data plate: provide rail systems with prominently displayed, non-corrosive plate clearly stating Maximum Service Capacity, Maximum number of users, Manufacturer's name, Serial number and Manufacturing Date.
- .3 Trolleys: heavy duty rollers and 16 mm diameter U-bar safety anchors. Fabricate from Type 304 stainless steel. Design trolleys to run freely under load with minimum discontinuity at rail splices. Provide end stops to ensure trolley cannot become detached from the rail. Design stops to be removable for service.
- .4 Safety U-bars: Type 304 stainless steel with yield strength of 240 MPa (35 Ksi). Minimum 19 mm diameter material with 38 mm eye opening.
- .5 Securement bolts: mild steel, Type 300W with yield strength of 300 MPa (44 Ksi), hot dipped galvanized to ASTM A123. Base plate and all other sections: galvanized mild steel as above with yield strength of 300 MPa (44 Ksi). Thickness and securement to suit application.
- .6 Tethers: secure all pins and loose pieces with 3 mm stainless steel cable complete with easily inserted lead connectors to avoid loss.

## **2.04 FABRICATION**

- .1 Fabricate items with joints tightly fitted and secured.
- .2 Continuously seal joined members by continuous welds.
- .3 Grind exposed joints flush and smooth with adjacent finish surface.
  - .1 Make exposed joints butt tight, flush, and hairline.
  - .2 Ease exposed edges to small uniform radius.
- .4 Exposed mechanical fastenings: Use screws or bolts consistent with design of component.
- .5 Furnish and install components required for anchorage of fabrications.
- .6 Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

## **PART 3 Execution**

### **3.01 EXAMINATION**

- .1 Examine surfaces and areas of work. Report to the Consultant in writing, defects of work prepared by other trades and other unsatisfactory site conditions, which would cause defective installation of products, or cause latent defects in workmanship and function.
- .2 Verify dimensions, tolerances, and method of attachment with other work.
- .3 Commencement of work will imply acceptance of prepared work.

### **3.02 PREPARATION**

- .1 Supply and install steel items required to be attached to steel framing, with setting templates to appropriate sections.

### **3.03 INSTALLATION**

- .1 Install equipment in accordance with approved shop drawings and manufacturer's recommendations.

- .2 Co-ordinate installation with work of related trades.
- .3 Install all work plumb, true, level, accurately and tightly fitted and flush with adjacent surfaces as required. Install work free from distortion or defects.
- .4 Deform threads of tail end of anchor studs after nuts have been tightened to prevent accidental removal or vandalism.
- .5 Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- .6 Obtain approval from Consultant prior to site cutting or making adjustments not scheduled.
- .7 Thread cable through eye-lets at top of post, to linear roof coverage of post restraints; pressure crimp cable ends.
- .8 Install aluminum flashing to pier supports in accordance with CRCA recommendations. Seal top of aluminum flashing with mastic tape. Install rubber flashing collar and heat to seal.
- .9 Install data plate at all attachment points to the system. Locate and mount plate as required to ensure it is prominently displayed and visible to all workers entering the space.
- .10 Install air terminals to all exterior components. Co-ordinate with Electrical for connection to building Lightning Arrest system.
- .11 Adjust and leave equipment in proper working order.

#### **3.04 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written reports from manufacturer verifying compliance of Work in regards to installation and commissioning of system.
  - .2 Ensure manufacturer's representative is present before and during critical periods of installation and testing.
  - .3 Schedule a minimum of 3 site visits to review Work at stages as directed by Consultant.
  - .4 Complete "Initial Inspection - Certification for Use" form included in Equipment Manual & Inspection Log Book.

#### **3.05 ERECTION TOLERANCES**

- .1 Maximum Variation from plumb and level: 3 - 6 mm.

#### **3.06 PROTECTION OF FINISHED WORK**

- .1 Protect finished Work from damage.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Division 22 – Plumbing
- .2 Division 23 – Heating, Ventilating and Air-Conditioning (HVAC)

**1.2 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings to show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify current model production.
  - .5 Certification of compliance to applicable codes.
- .4 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2 Operation and maintenance manual approved by, and final copies deposited with, Engineer, 2 weeks before final inspection.
  - .3 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.
    - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    - .4 Operation instruction for systems and component.
    - .5 Description of actions to be taken in event of equipment failure.
    - .6 Valves schedule and flow diagram.
    - .7 Colour coding chart.
  - .4 Maintenance data to include: Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .5 Performance data to include:
    - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
    - .2 Equipment performance verification test results.
    - .3 Special performance data as specified.
    - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  - .6 Approvals:

- .1 Submit 3 copies of draft Operation and Maintenance Manual to Engineer for approval.
- .2 Make changes as required and re-submit as directed by Engineer.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Engineer will provide 1 set of reproducible mechanical drawings. Provide set of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Use different colour waterproof ink for each service.
  - .3 Make available for reference purposes and inspection.
- .9 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED".
  - .3 Submit to Engineer for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

### **1.3 QUALITY ASSURANCE**

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

### **1.4 MAINTENANCE**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Materials and products in accordance with Section 01 00 10 – General Instructions

## **Part 3 Execution**

### **3.1 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct tests in accordance with Section [01 45 00 - Quality Control] [ ] and submit report as described in Section 01 33 00 – Submittal Procedures
- .2 Manufacturer's Field Services:

- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Section 01 33 00 – Submittal Procedures.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work.

### **3.2 DEMONSTRATION**

- .1 Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.

### **3.3 PROTECTION**

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

**END OF SECTION**

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**PART 1 General**

**1.1 RELATED SECTIONS**

- .1 For LEED Reference see Division 01.
- .2 Mechanical General Provisions: Section 21 05 01.

**1.2 REFERENCES**

- .1 Conform to CHVAC, ULC S114 and ASTM C411-61, latest editions.
- .2 Fire Hazard Rating:
  - .1 Meet NFPA 90A. NFPA 225, ULC S102 and UL-465, latest editions.
- .3 Materials, standards and applications shall conform to Thermal Insulation Association of Canada (TIAC).

**1.3 REQUIREMENTS OF REGULATORY AGENCIES**

- .1 Insulation system materials shall satisfy fire hazard rating of 25 for flame spread and 50 for smoke developed.

**1.4 DEFINITIONS**

- .1 "Concealed" means insulated mechanical services in trenches, chases, furred spaces, pipe shafts, or hung ceilings.
- .2 "Exposed" will mean all work which is not "concealed" as defined herein.

**PART 2 Products**

**2.1 STANDARDS OF ACCEPTANCE**

- .1 Insulation Materials: Only the following materials listed are acceptable for use on this project.
- .2 Coatings, Sealers and Adhesives:
  - .1 Benjamin Foster Co.
  - .2 Minnesota Mining and Mfg. of Canada Ltd.
  - .3 The Flintkote Co.
  - .4 Jacobs and Thompson.
  - .5 Duro-Dyne.
- .3 Caulking Compound:
  - .1 Canadian General Electric.
  - .2 Dow Corning
- .4 Tape:
  - .1 ARNO Dr. Scholl's Tape Division
  - .2 3M
  - .3 Duro-Dyne



- .5 Glass Fibre Insulation for Fittings and Equipment:
  - .1 Insulcoustics Ltd., Ottawa
  - .2 Ottawa Fibre Industries Ltd.
  - .3 Manson
  - .4 Fibreglass Canada
  - .5 Armstrong World Industries
  - .6 Knauf

- .6 ULC Labelled Canvas Jackets or Fittings:
  - .1 S. Fattal Cotton Inc.
  - .2 Thermocanvas

## 2.2 JACKETS

- .1 Thermo-Canvas Jackets, c/w ULC S-102 Label:
  - .1 Use 225 g thermocanvas jacket finish on all insulated, exposed piping and ductwork indoors, on all concealed valves and fittings for plumbing and heating.
- .2 PVC Jacket:
  - .1 Provide to CGSB 51-GP-53M, off white, self-extinguishing, with flame spread less than 25, fuel contribution rating of 0 and maximum perm rating of 0.01 perm inches.
  - .2 Minimum thickness of 0.20 mm.
  - .3 Fittings covers to be one-piece, pre-molded to suit.
- .3 Acceptable Products:
  - .1 Fattal Thermocanvas
  - .2 Clairmont Display Co.
  - .3 Alpha Maritex 3451 RW

## 2.3 VAPOUR BARRIER

- .1 Provide to CGSB 51-GP-52M vapour barriers for pipe, duct and equipment insulation. Type 2: moderate puncture resistance.
- .2 Acceptable Products:
  - .1 Canadian Johns Manville Flamebar
  - .2 WFB and BFB Alumi-seal "Zero-Perm"

## 2.4 WEATHERPROOF CAULKING

- .1 At flashings, wherever barrier joint is required, and at expansion joints, provide heat resistant caulking, set into fabric reinforcing cloth extending 75 mm each side of caulk line.

## 2.5 PIPING COMPONENTS

- .1 In all pipe, fittings and elbows build up ends of insulation on piping with segmented, pre-formed pipe insulation cut to same thickness as adjoining pipe insulation.
- .2 Vapour seal ends of insulation with pressure sensitive vapour barrier adhesive and polyethylene tapes.
- .3 Fasteners: stainless steel or aluminum insulation straps for all piping.

## 2.6 DUCTWORK COMPONENTS

- .1 Fastening:
  - .1 Insulation cement and self-adhesive aluminum tape.
  - .2 Insulation cement and weld pins with clip stops.
- .2 Jackets:
  - .1 Jackets on exposed ductwork of types indicated shall be continuous over any vapour barrier or coating.
  - .2 Lap seams minimum 50 mm in least visible location. Use adhesive lagging to secure overlapping edges.
  - .3 Provide, in mechanical rooms, galvanized steel corner beads on rigid insulation complete with thermocanvas covering.

## 2.7 PIPE INSULATION

- .1 Mineral Fibre Insulation:
  - .1 Piping:
    - .1 Preformed mineral fibre insulation with integral jacket.
    - .2 Flexible elastomeric thermal insulation for pipe and fittings may be used in place of mineral fibre on refrigeration piping.
  - .2 Fittings:
    - .1 Insulate all fittings, flanges, pump bodies, strainers, and valve bodies with factory pre-cut, flexible insulation having a K-factor of not more than 0.04 W/m<sup>2</sup>°C at 24°C.
    - .2 On fittings, where the medium temperature exceeds 95°C, provide two (2) layers of insulation, tied in place.
  - .3 Applications: Use mineral fibre insulation for both concealed and exposed areas unless noted otherwise, on the following:
    - .1 All domestic hot, recirculation and cold water mains, risers and piping except for runouts from wall to fixtures.
    - .2 All rainwater piping for a minimum horizontal distance of 5.0 m from and including the hopper up to underside of roof in concealed areas. Where rainwater piping is exposed (both horizontal and vertical) insulate entire length until point of concealment, including hopper to underside of roof.
    - .3 Hot and cold water, rainwater and sanitary drainage piping in soffit spaces, following heat tracing, where applicable
    - .4 Hydronic heating lines.
    - .5 Humidifier piping.
  - .4 Finishes: Piping and fittings in concealed areas shall require no additional finish from that specified above.
  - .5 Piping installed on roof to be complete with PVC jacket with all seams sealed with an approved vapour barrier adhesive mastic.

## 2.8 REFRIGERATION LINE INSULATION

- .1 25 mm pre-formed flexible elastomeric type insulation equal to Armstrong Ltd. "Armaflex II" shall be installed on all suction and discharge refrigeration lines.
  - .1 Suitable for pipe temp. of -40°C to 100°C.
  - .2 K-factor = 0.27. Adhesive shall be Armstrong 520 or approved equal for alternate materials.
  - .3 Sealants shall be latex caulking compounds approved by the insulation manufacturer.
  - .4 Entire insulation assembly to meet the code requirements for interior application smoke generation and flame spread and to be certified by ULC for this application.
- .2 Finish with vinyl lacquer coating supplied by insulation manufacturer.

## 2.9 DUCT INSULATION

- .1 Rigid Insulation:
  - .1 Ducting and Fittings: Pre-formed mineral fibre rigid insulation with vapour barrier.
  - .2 Vapour Barrier:
    - .1 Vapour barrier shall be composed of aluminum foil (min. 0.7 mil thick), reinforced with fiberglass yarn mesh and laminated to permanently treated fire resistant kraft paper.
  - .3 Application:
    - .1 Outside air intakes from louvers to connection to equipment, 50 mm thick.
    - .2 All rectangular exhaust air ductwork for a minimum distance of 2 metres from the terminal roof or exterior wall openings, or as noted on the drawings, 50 mm thick.
    - .3 All rectangular supply air ducts from units containing cooling coils, to exit of Duct Shafts, 25 mm thick.
    - .4 All outside air ducts, full length such as combustion air, miscellaneous air intake open ended (50 mm thick).
  - .4 Thermal insulation may be deleted on any ductwork lined with acoustic insulation.
- .2 Flexible Insulation:
  - .1 Ducting and Fittings:
    - .1 Flexible insulation with factory applied vapour barrier to be composed of fibrous glass formed into a flexible blanket and be suitable for application on exterior of round ducts. Do not use on rectangular ductwork. Flexible insulation shall meet or exceed the following physical property requirements and comply with at least one of the following specifications.
  - .2 Vapour Barrier:
    - .1 The vapour barrier shall be composed of aluminum foil (min. 0.7 mil thick), reinforced with fibre glass yarn mesh and laminated to permanently treated fire resistant kraft paper.
  - .3 Application:
    - .1 Insulate circular exhaust air ducts for a minimum distance of 2 meters from the roof terminal or exterior wall opening, or as noted on drawing, 50 mm thick.
    - .2 Unheated outside air ducts, 50 mm thick.

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**PART 3      Execution**

**3.1            APPLICATION**

- .1      Apply insulation after required tests have been complete and approved by the Engineer. Insulation and surfaces shall be clean and dry when installed and during application of any finish.
- .2      Work to be performed by insulation journeymen and in strict accordance with TIAC Standards.

**3.2            PIPE INSULATION**

- .1      Multi-layered insulation: use staggered butt joint construction.
- .2      Vertical Pipe over 75 mm: use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Thereafter locate on 4.5 m centres and at each valve and flange.
- .3      Install expansion joints as required. Terminate single layer and each layer of multiple layers in straight cut. Leave 25 mm space between terminations. Pack void tightly with glass wool. Protect joints with stainless steel sleeves.
- .4      For valves, fittings and process equipment requiring periodic maintenance of parts and sub-assemblies listed or indicated, use factory fabricated, easily disassembled insulation. Submit samples for Engineer's approval.
- .5      Terminate insulation at each end of unions and flanges on hot lines, and at other points where indicated, with insulation cement to CGSB 51-GP-6M, toveled on bevel. Provide removable preformed insulation section for union cover.
- .6      Gouge out insulation for proper fit where interference occurs between weld bead and insulation. Bevel insulation away from studs and nuts to permit their removal without damage to insulation, and trim closely and neatly around extending parts of pipe saddles, supports, hangers, and clamp guides and seal with insulating cement.
- .7      Secure pipe insulation by straps. Space straps at not more than 900 mm on centres and use at least three (3) rows per length of insulation section.

**3.5            DUCT INSULATION**

- .1      General:
  - .1      Joints to be on top of ducts.
  - .2      Adhere and seal vapour barrier using vapour seal adhesives.
  - .3      Stagger longitudinal and horizontal joints on multi-layered insulation.
- .2      Mechanical Fasteners:
  - .1      On rectangular ducts use 50% coverage of insulating cement and weld pins at not more than 200 mm centres, but not less than two (2) rows per side.
  - .2      On round ducts use 100% coverage of insulating cement and self-adhesive tape on joints.

**3.5            FINISHING**

- .1      Provide ULC approved fire retardant coating on canvas jackets.

- .2 Coat canvas covering exposed in finished spaces with diluted coat of lagging adhesive, as recommended by insulation manufacturer for priming.

### **3.6 BARRIER FREE LAVATORY PIPE INSULATION**

- .1 Insulate all exposed piping (DCW, DHW and drainage) under barrier-free lavatories with PVC jacketing.

END OF SECTION

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1        Pipe, fittings, valves, and connections for sprinkler and standpipe systems.

**1.2            RELATED SECTIONS**

- .1        Section 21 13 00 - Sprinklers: Sprinkler system design.
- .2        Section 23 05 53 - Mechanical Identification: Piping identification.

**1.3            REFERENCES**

- .1        ASME B16.1-2010 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- .2        ASME B16.11-2011 - Forged Steel Fittings, Socket Welding and Threaded.
- .3        ASME B16.25-2012 - Buttwelding Ends.
- .4        ASME B16.3-2011 - Malleable Iron Threaded Fittings: Classes 150 and 300.
- .5        ASME B16.4-2011 - Gray Iron Threaded Fittings: Classes 125 and 250.
- .6        ASME B16.5-2013 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
- .7        ASME B16.9-2012 - Factory-Made Wrought Steel Buttwelding Fittings.
- .8        ASME B36.10M-2004 (R2010) - Welded and Seamless Wrought Steel Pipe.
- .9        ASME Boiler and Pressure Vessel Code (BPVC), Section IX-2103 - Welding and Brazing Qualifications.
- .10       ASTM A47/A47M-99(2009) - Standard Specification for Ferritic Malleable Iron Castings.
- .11       ASTM A53/A53M-12 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .12       ASTM A135/A135M-09 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
- .13       ASTM A234/A234M-13 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .14       ASTM A795/A795M-13 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- .15       ASTM B32-08 - Standard Specification for Solder Metal.
- .16       AWS A5.8/A5.8M-2011-AMD 1 - Specification for Filler Metals for Brazing and Braze Welding.
- .17       AWS D10.10/D10.10M-1999 (R2009) - Recommended Practices for Local Heating of Welds in Piping and Tubing.
- .18       AWWA C110/A21.10-12 - Ductile-Iron and Gray-Iron Fittings for Water.

- .19 AWWA C111/A21.11-12 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .20 AWWA C151/A21.51-09 - Ductile-Iron Pipe, Centrifugally Cast.
- .21 CSA (Canadian Standards Association).
- .22 NFPA 13 - Standard for the Installation of Sprinkler Systems, 2013 Edition.
- .23 NFPA 14 - Standard for the Installation of Standpipe and Hose Systems, 2013 Edition.
- .24 UL 405-2013 - Standard for Fire Department Connection Devices (6th Edition).

#### **1.4 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- .3 Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

#### **1.5 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 10: Submission procedures.
- .2 Record Documentation: Record actual locations of components and tag numbering.
- .3 Operation and Maintenance Data: Include installation instructions and spare parts lists.

#### **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Section 01 78 40: Maintenance and extra material requirements.
- .2 Spare Parts: Provide two (2) valve stem packings for each size and type of valve installed.

#### **1.7 REGULATORY REQUIREMENTS**

- .1 Conform to UL/FM.
- .2 Sprinkler Systems: Conform work to NFPA 13.
- .3 Standpipe and Hose Systems: Conform to NFPA 14.
- .4 Valves: Bear UL/FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

#### **1.8 DELIVERY, STORAGE, AND PROTECTION**

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Deliver and store valves in shipping containers, with labelling in place.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

**Part 2 Products**

**2.1 BURIED PIPING**

- .1 Steel Pipe: Black or galvanized with polyethylene jacket, or double layer, half-lapped 0.25 mm polyethylene tape.
  - .1 Joints: welded.

**2.2 ABOVE GROUND PIPING**

- .1 Steel Pipe: Black or galvanized.
  - .1 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, C-shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

**2.3 PIPE HANGERS AND SUPPORTS**

- .1 Conform to NFPA 13 and NFPA 14.
- .2 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- .3 Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- .4 Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- .5 Vertical Support: Steel riser clamp.
- .6 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Ream pipe and tube ends. Remove burrs.
- .2 Remove scale and foreign material, from inside and outside, before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

**3.2 INSTALLATION**

- .1 Install piping to NFPA 13 for sprinkler systems and NFPA 14 for standpipe and hose systems.
- .2 Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- .3 Install piping to conserve building space, to not interfere with use of space and other work.
- .4 Group piping whenever practical at common elevations.
- .5 Sleeve pipes passing through partitions, walls, and floors.



- .6 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .7 Inserts:
  - .1 Provide inserts for placement in concrete formwork.
  - .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - .3 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- .8 Pipe Hangers and Supports:
  - .1 Install to NFPA 13 and NFPA 14.
  - .2 Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - .3 Place hangers within 12 inches of each horizontal elbow.
  - .4 Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - .5 Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
  - .6 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- .9 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- .10 Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- .11 Do not penetrate building structural members unless indicated.
- .12 Provide sleeves when penetrating floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- .13 When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- .14 Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- .15 Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.
- .16 Provide valves for shut-off or isolating service.
- .17 Provide drain valves at main shut-off valves, low points of piping and apparatus.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1      Standpipe network.
- .2      Fire hose cabinets.
- .3      Fire department connection.

**1.2            RELATED SECTIONS**

- .1      Section 21 11 00 - Fire Protection Piping.
- .2      Section 21 30 00 - Fire Pumps.
- .3      Section 21 13 00 - Sprinklers.
- .4      Section 23 05 53 - Mechanical Identification.
- .5      Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3            REFERENCES**

- .1      NFPA 14 - Standard for the Installation of Standpipe and Hose Systems, 2013 Edition.

**1.4            SUBMITTALS FOR REVIEW**

- .1      Section 01 33 00: Submission procedures.
- .2      Product Data: Provide manufacturer's catalogue sheet for equipment indicating rough-in size, finish, and accessories.
- .3      Shop Drawings: Indicate supports, components, accessories, and sizes. Submit Shop Drawings and Product data to Owner's insurance underwriter for approval. Submit proof of approval to Consultant.

**1.5            CLOSEOUT SUBMITTALS**

- .1      Section 01 78 10: Submission procedures.
- .2      Operation Data: Include manufacturer's data.
- .3      Maintenance Data: Include servicing requirements and test schedule.
- .4      Record Documentation: Record actual locations of components.

**1.6            MAINTENANCE MATERIAL SUBMITTALS**

- .1      Section 01 78 40: Maintenance and extra material requirements.
- .2      Extra Stock Materials: Provide two (2) of hose nozzles and hoses.

**1.7            QUALITY ASSURANCE**

- .1      Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2      Perform Work to NFPA 14. Maintain one (1) copy of document on site.

**1.8 DELIVERY, STORAGE, AND PROTECTION**

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Deliver and store products in shipping packaging until installation.

**Part 2 Products**

**2.1 FIRE HOSE CABINETS**

- .1 Hose Cabinets:
  - .1 Style: As indicated.
  - .2 Tub: 16 gauge thick steel, prepared for pipe and accessory rough-in.
  - .3 Door: 12 gauge thick steel, with 1/4 inch thick wired glass full panel, hinged, positive latch device.
  - .4 Finish: Refer to architectural drawings.
- .2 Hose Rack: Steel; with polished chrome finish; swivel type with pins and water stop.
- .3 Hose: 100 f long, of polyurethane lined synthetic hose; mildew and rot-resistant.
- .4 Nozzle: Chrome plated, combination fog, straight stream, and adjustable shut-off.

**2.2 VALVES**

- .1 Hose Station Valve: Angle type, chrome plated finish 1-1/2 inch nominal size with automatic ball drip.
- .2 Hose Connection Valve: Angle type; chrome plated finish; 2-1/2 inch size, thread to match fire department hardware, 300 psi working pressure, with threaded cap and chain of same material and finish.

**2.3 FIRE DEPARTMENT CONNECTION**

- .1 Fire Department Connection: Flush mounted wall type, chrome plated finish.
- .2 Outlets: Two-way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
- .3 Drain: 3/4 inch automatic drip, connected to drain.
- .4 Label: STANDPIPE - FIRE DEPARTMENT CONNECTION.

**2.4 FIRE EXTINGUISHERS**

- .1 Multi-Purpose Dry Chemical: Cartridge operated with hose and shut-off nozzle or integral shut-off nozzle.
  - .1 10 lb capacity with 4A:60BC rating.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install system to NFPA 14 and manufacturer's written instruction.

- .2 Locate and secure cabinets plumb and level. Establish top of cabinet (inside horizontal surface) 66 inches above finished floor.
- .3 Locate hose station valve in cabinet at 60 inches above floor. Locate hose connection valve below hose station valve and not closer than 4 inches from side or bottom of cabinet.
- .4 Locate dry chemical fire extinguisher in cabinet.
- .5 Connect standpipe system to water source ahead of domestic water connection.
- .6 Flush entire system of foreign matter.

**3.2 FIELD QUALITY CONTROL**

- .1 Test entire system to NFPA 14.
- .2 Test shall be witnessed by authority having jurisdiction, Owner's insurance underwriter and Consultant.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Wet-pipe sprinkler assembly.
- .2    Dry-pipe sprinkler assembly.
- .3    System design, installation, and certification.
- .4    Fire department connections.

**1.2            RELATED SECTIONS**

- .1    Section 21 12 00 - Standpipe And Fire Hose.
- .2    Section 23 05 53 - Mechanical Identification.
- .3    Section 23 05 48 - Vibration Isolation.
- .4    Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3            REFERENCES**

- .1    CSA (Canadian Standards Association).
- .2    FM (Factory Mutual) - Approval Guide.
- .3    NFPA 13 - Standard for the Installation of Sprinkler Systems, 2013 Edition.
- .4    UL - Fire Resistance Directory.

**1.4            SYSTEM DESCRIPTION**

- .1    System to provide coverage for entire building areas noted on drawing.
- .2    Provide system to NFPA 13, light hazard occupancy requirements.
- .3    Determine volume and pressure of incoming water supply from water flow test data.
- .4    Interface system with building fire and smoke alarm system.
- .5    Provide fire department connections where indicated.

**1.5            SUBMITTALS FOR REVIEW**

- .1    Section 01 33 00: Submission procedures.
- .2    Product Data: Provide data on sprinklers, valves, and specialties, including manufacturer's catalogue information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- .3    Shop Drawings:
  - .1    Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
  - .2    Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

- .4 Submit shop drawings and hydraulic calculations to authority having jurisdiction and Owner's insurance underwriter for approval. Submit proof of approval to Consultant.

## **1.6 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submission procedures.
- .2 Manufacturer's Certificate: Certify that system has been tested and meets or exceeds code requirements.

## **1.7 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 10: Submission procedures.
- .2 Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- .3 Record Documentation: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- .4 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## **1.8 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Section 01 78 40: Maintenance and extra material requirements.
- .2 Extra Stock Materials:
  - .1 Provide extra sprinklers to NFPA 13.
  - .2 Provide metal storage cabinet in location designated.
- .3 Tools: Provide suitable wrenches for each sprinkler type.

## **1.9 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Perform Work to NFPA 13
- .3 Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed at the place where the Project is located.

## **1.10 REGULATORY REQUIREMENTS**

- .1 Conform to UL and FM.
- .2 Perform Work to NFPA 13.
- .3 Equipment and Components: Bear UL and FM label or marking.

## **1.11 DELIVERY, STORAGE, AND PROTECTION**

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

**Part 2 Products**

**2.1 SPRINKLERS**

- .1 Suspended Ceiling: Concealed pendant type with matching push on escutcheon plate
  - .1 Finish: Chrome plated.
  - .2 Fusible Link: Temperature rated for specific area hazard.
- .2 Exposed Area Type: Standard upright type with guard.
  - .1 Finish: Chrome plated.
  - .2 Fusible Link: Temperature rated for specific area hazard.
- .3 Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
  - .1 Finish: Chrome plated.
  - .2 Escutcheon Plate Finish: Chrome plated.
  - .3 Fusible Link: Temperature rated for specific area hazard.
- .4 Dry Sprinklers: Recessed pendant type with matching push on escutcheon plate.
  - .1 Finish: Chrome plated.
  - .2 Fusible Link: Temperature rated for specific area hazard.
- .5 Guards: Finish to match sprinkler finish.

**2.2 PIPING SPECIALTIES**

- .1 Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.
- .2 Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with accelerator; with test and drain valve.
- .3 Flooding Deluge Valve: Gate type valve with rubber faced disc actuated electrically with water motor alarm and electric alarm, with alarm testing trim.
- .4 Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy red enameled gong and motor housing, nylon bearings, and inlet strainer.
- .5 Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.
- .6 Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- .7 Fire Department Connections: Flush mounted wall type with chrome plated finish.
  - .1 Outlets: Two-way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
  - .2 Drain: 3/4 inch automatic drip, connected to drain.
  - .3 Label: SPRINKLER - FIRE DEPARTMENT CONNECTION.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install to NFPA 13 and to manufacturer's written instructions.
- .2        Install buried shut-off valves in valve box. Provide post indicator.
- .3        Provide approved double check valve backflow preventer assembly at sprinkler system water source connection.
- .4        Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- .5        Place pipe runs to minimize obstruction to other work.
- .6        Place piping in concealed spaces above finished ceilings.
- .7        Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- .8        Flush entire piping system of foreign matter.
- .9        Install guards on sprinklers where indicated.
- .10       Hydrostatically test entire system.
- .11       Require test be witnessed by authority having jurisdiction, Owner's insurance underwriter and Consultant.

**3.2                INTERFACE WITH OTHER PRODUCTS**

- .1        Ensure required devices are installed and connected as required to fire alarm system.

**END OF SECTION**



**Part 1            General**

**1.1            SECTION INCLUDES**

- .1      Pipe, pipe fittings, valves, and connections for sanitary, domestic water, storm water and natural gas piping systems.

**1.2            RELATED SECTIONS**

- .1      Section 08 31 00 - Access Doors and Frames.
- .2      Section 23 05 53 - Mechanical Identification.
- .3      Section 21 07 20 - Piping Insulation.
- .4      Section 31 23 33 – Excavating, Trenching and Backfill

**1.3            REFERENCES**

- .1      ASME B16.18-2012 - Cast Copper Alloy Solder Joint Pressure Fittings.
- .2      ASME B16.22-2013 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .3      ASME B16.23-2011 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- .4      ASME B16.26-2013 - Cast Copper Alloy Fittings for Flared Copper Tubes.
- .5      ASME B16.29-2012 - Wrought Copper And Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- .6      ASME B16.50-2013 - Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings.
- .7      ASME B31.1-2012/B31.3-2012 - Power Piping and Process Piping (Set).
- .8      ASME B31.2-1968 - Fuel Gas Piping.
- .9      ASME B31.9-2011 - Building Services Piping.
- .10     ASME Boiler and Pressure Vessel Code (BPVC), Section IX-2103 - Welding and Brazing Qualifications.
- .11     ASTM A53/A53M-12 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .12     ASTM A74-13a - Standard Specification for Cast Iron Soil Pipe and Fittings.
- .13     ASTM A234/A234M-13 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .14     ASTM A312/A312M-13b - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- .15     ASTM A774/A774M-13 - Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
- .16     ASTM B32-08 - Standard Specification for Solder Metal.
- .17     ASTM B75/B75M-11 - Standard Specification for Seamless Copper Tube.
- .18     ASTM B88M-13 - Standard Specification for Seamless Copper Water Tube.
- .19     ASTM B88-09 - Standard Specification for Seamless Copper Water Tube.

- .20 ASTM B280-13 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .21 ASTM B306-13 - Standard Specification for Copper Drainage Tube (DWV).
- .22 ASTM B837-10 - Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
- .23 ASTM C564-12 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .24 ASTM C1053-00(2010) - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
- .25 ASTM D2235-04(2011) - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- .26 ASTM D2241-09 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- .27 ASTM D2464-13 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- .28 ASTM D2513-13 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings.
- .29 ASTM D2564-12 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- .30 ASTM D2683-10e1 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
- .31 ASTM D3138-04(2011) - Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components.
- .32 ASTM E814-13a - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .33 ASTM F708-92(2008) - Standard Practice for Design and Installation of Rigid Pipe Hangers.
- .34 ASTM F1281-11 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX AL PEX) Pressure Pipe.
- .35 ASTM G17-07(2013) - Standard Test Method for Penetration Resistance of Pipeline Coatings (Blunt Rod).
- .36 AWS A5.8/A5.8M-2011-AMD 1 - Specification for Filler Metals for Brazing and Braze Welding.
- .37 AWWA C105/A21.5-10 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
- .38 AWWA C651-05 - Disinfecting Water Mains.
- .39 CAN/CSA-B70-12 - Cast Iron Soil Pipe, Fittings, and Means of Joining.
- .40 CAN/CSA-B1800-11 - Thermoplastic Nonpressure Piping Compendium.
- .41 CAN/ULC-S102.2-10 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
- .42 ANSI Z21.22-1999/CSA 4.4-M99 (R2008) - Relief Valves for Hot Water Supply Systems.  
MSS SP-110-2010 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

- .43 MSS SP-58-2009 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- .44 MSS SP-67-2011 - Butterfly Valves.
- .45 MSS SP-70-2011 - Gray Iron Gate Valves, Flanged and Threaded Ends.
- .46 MSS SP-71-2011 - Gray Iron Swing Check Valves, Flanged and Threaded Ends.
- .47 MSS SP-78-2011 - Cast Iron Plug Valves, Flanged and Threaded Ends.
- .48 MSS SP-80-2013 - Bronze Gate, Globe, Angle and Check Valves.
- .49 MSS SP-85-2011 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
- .50 NFPA 54/ANSI Z223.1 - National Fuel Gas Code, 2012 Edition.
- .51 NFPA 58 - Liquefied Petroleum Gas Code, 2014 Edition.
- .52 UL 1479-2003 - Standard for Fire Tests of Through-Penetration Firestops (3rd Edition).

**1.4 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data on valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Submission procedures.
- .2 Provide maintenance data for incorporation into O & M Manual
- .3 Record Documentation: Record actual locations of valves on Valve Tag Schedule.
- .4

**1.6 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 9000 or ISO 14000 certification requirements.
- .2 Perform Work to Province of Ontario standards. Maintain one copy of document on site.
- .3 Valves: Manufacturer's name and pressure rating marked on valve body.
- .4 Welding Materials and Procedures: Conform to ASME BPVC-Section IX.
- .5 Welder's Certification: To ASME BPVC-Section IX.

**1.7 REGULATORY REQUIREMENTS**

- .1 Perform Work to Ontario Building Code.
- .2 Conform to applicable code for installation of backflow prevention devices.
- .3 Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

**1.8 DELIVERY, STORAGE, AND PROTECTION**

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- .3 Provide temporary protective coating on cast iron and steel valves.

- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

## **1.9 SITE CONDITIONS**

- .1 Ambient Conditions: Do not install underground piping when bedding is wet or frozen.

## **Part 2 Products**

### **2.1 SANITARY SEWER AND STORM WATER PIPING, BELOW GROUND**

- .1 PVC Pipe: CAN/CSA-B1800, SDR 35 pipe.

### **2.2 SANITARY SEWER PIPING, ABOVE GROUND**

- .1 Cast Iron Pipe: [CAN/CSA-B70.
  - .1 Fittings: Hubless Cast Iron Pipe Fittings: FSWW-P-401.
  - .2 Joints: ASTM C564, rubber or compression gaskets.
- .2 Copper Tube: ASTM B306, DWV.
  - .1 Fittings: ASME B16.23 cast bronze, ASME B16.29 wrought copper.
  - .2 Joints: Joints: ASTM B32, soldered, AWS A5.8/A5.8M brazed.
- .3 PVC Pipe: CAN/CSA-B1800, flame spread rating 15.
  - .1 Fittings: CAN/CSA-B1800, socket type, flame spread rating 15.
  - .2 Joints: ASTM D2564 solvent cement and primer.

### **2.3 CHEMICAL RESISTANT SEWER PIPING**

- .1 PVC Pipe: CAN/CSA-B1800, and CAN/ULC-S102.2, flame spread rating 15.
  - .1 Fittings: CAN/CSA-B1800, socket type and CAN/ULC-S102.2, flame spread rating 15.
  - .2 Joints: ASTM D2564 solvent cement and primer.

### **2.4 DOMESTIC WATER PIPING, BELOW GROUND**

- .1 UPVC Pipe or SDR-18
  - .1 Fittings: Compression Gaskets with Thrust Restraint and thrust block at each change in direction
  - .2 Joints: Compression Gaskets with Thrust Restraint only

### **2.5 DOMESTIC WATER PIPING, ABOVE GROUND**

- .1 Copper Tubing: ASTM B88, Type M, hard drawn.
  - .1 Fittings: ASME B16.18 cast copper alloy, ASME B16.22 wrought copper and bronze, ASME B16.26 cast copper alloy, ASME B16.50 wrought copper.
  - .2 Joints: ASTM B32, soldered, AWS A5.8/A5.8M brazed.

### **2.6 STORM WATER PIPING, ABOVE GROUND**

- .1 Cast Iron Pipe: CAN/CSA-B70.

- .1 Fittings: Hubless Cast Iron Pipe Fittings: FSWW-P-401.
- .2 Joints: ASTM C564, rubber or compression gaskets.
- .2 Copper Tube: ASTM B306, DWV.
  - .1 Fittings: ASME B16.23, cast bronze, ASME B16.29, wrought copper.
  - .2 Joints: Joints: ASTM B32, soldered, AWS A5.8/A5.8M braze].
- .3 PVC Pipe: CAN/CSA-B1800, flame spread rating 15.
  - .1 Fittings: CAN/CSA-B1800, socket type, flame spread rating 15.
  - .2 Joints: ASTM D2564, solvent cement and primer.

## **2.7 NATURAL GAS PIPING, BELOW GROUND**

- .1 Polyethylene Pipe: ASTM D2513, SDR 11.5.
  - .1 Fittings: ASTM D2683, ASTM D2513, socket type.
  - .2 Joints: Fusion welded.

## **2.8 NATURAL GAS PIPING, INSIDE BUILDING**

- .1 Steel Pipe: ASTM A53/A53M, Schedule 40, Grade B black steel pipe, electric resistance welded.
  - .1 Fittings: ASME B16.3, malleable iron threaded fittings (for pipe diameters up to 50 mm or ASME B16.9, wrought steel butt welding fittings.
  - .2 Joints: Steel flanges and fittings to ASME B16.5; unions to ASME B16.9.

## **2.9 FLANGES, UNIONS, AND COUPLINGS**

- .1 Ferrous Pipe Size 75 mm and Under: Class 150 malleable iron threaded unions.
- .2 Copper Tube and Pipe Size 75 mm and Under: Class 150 bronze unions with soldered joints.
- .3 Ferrous Pipe Size Over 25 mm: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
- .4 Copper Tube and Pipe Size Over 25 mm: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- .5 Grooved and Shouldered Pipe End Couplings:
  - .1 Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
  - .2 Sealing gasket: C-shape composition sealing gasket.
- .6 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

## **2.10 PIPE HANGERS AND SUPPORTS**

- .1 Plumbing Piping - Drain, Waste, and Vent:
  - .1 Conform to ASME B31.9, ASTM F708, MSS SP-58, MSS SP-69.
  - .2 Hangers for Pipe Sizes 13 to 38 mm: Malleable iron or Carbon steel, adjustable swivel, split ring.
  - .3 Hangers for Pipe Sizes 50 mm and Over: Carbon steel, adjustable, clevis.

- .4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- .5 Wall Support for Pipe Sizes to [ $<75\text{ mm}><<3\text{ inches}>>$ ]: Cast iron hook.
- .6 Wall Support for Pipe Sizes [ $<100\text{ mm}><<4\text{ inches}>>$ ] and Over: Welded steel bracket and wrought steel clamp.
- .7 Vertical Support: Steel riser clamp.
- .8 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .2 Plumbing Piping - Water:
  - .1 Conform to ASME B31.9, ASTM F708, MSS SP-58, MSS SP-69.
  - .2 Hangers for Pipe Sizes 13 to 38 mm: Carbon steel or Malleable iron, adjustable swivel, split ring.
  - .3 Hangers for Cold Pipe Sizes 50 mm and Over: Carbon steel, adjustable, clevis.
  - .4 Wall Support for Pipe Sizes to 75 mm: Cast iron hook.
  - .5 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

## 2.11 Valve Schedule

- .1 Gate Valves:
  - .1 Gate Valves: 2" (50 mm) and Smaller, Threaded Ends Class 125
    - .1 Class 125, bronze body, solid wedge disc, screwed bonnet, rising stem, to MSS SP-80.
    - .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 428
      - .2 Jenkins 810J
      - .3 Kitz 24
      - .4 Toyo 293
      - .5 Milwaukee 148
      - .6 Approved Equivalent
  - .2 Gate Valves: 2" (50 mm) and Smaller, Solder Ends; Class 125
    - .1 Class 125 bronze body, solid wedge disc, screwed bonnet, rising stem, to MSS SP-80.
    - .2 Service: Domestic hot and cold water.
    - .3 Acceptable material:
      - .1 Crane 1334
      - .2 Jenkins 813J
      - .3 Kitz 44
      - .4 Toyo 299
      - .5 Milwaukee 149
      - .6 Approved Equivalent
  - .3 Gate Valves: 2½" (65 mm) and larger; Class 125, Mechanical Rooms
    - .1 Cast iron, ASTM A126, Class B, with solid wedge disc, bolted bonnet, OS&Y, flanged ends, to MSS SP-70.

- .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
- .3 Acceptable material:
  - .1 Crane 465½
  - .2 Jenkins 454J
  - .3 Kitz 72
  - .4 Toyo 421A
  - .5 Milwaukee F-2885-M
  - .6 Approved Equivalent
- .4 Gate Valves: 2½ (65 mm) and larger, Class 125, Locations Other than Mechanical Rooms
  - .1 Cast iron, ASTM A136, Class B, with solid wedge disc, bolted bonnet, non-rising stem, flanged ends, to MSS SP-70.
  - .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 461
    - .2 Jenkins 452J
    - .3 Kitz 75
    - .4 Toyo 415 A
    - .5 Milwaukee F-2882-M
    - .6 Approved Equivalent
- .5 Gate Valves: 2" (50 mm) and Smaller, ULC and FM Listed
  - .1 Bronze, Class 150, solid wedge disc, OS&Y, screwed ends, to MSS SP-80.
  - .2 Service: Fire protection systems.
  - .3 Acceptable material:
    - .1 Crane 459
    - .2 Jenkins 275J
    - .3 Approved Equivalent.
- .6 Gate Valves: 2½" (65 mm) and Larger, ULC and FM Listed
  - .1 Cast iron, ASTM A126, Class B, 175 psi (1207 kPa) cold working pressure, with solid wedge disc, bolted bonnet, OS&Y, flanged ends, to MSS SP-70.
  - .2 Service: Fire protection systems
  - .3 Acceptable material:
    - .1 Crane 467C
    - .2 Jenkins 825J
    - .3 Approved Equivalent
- .7 Gate Valves: 2" (50 mm) and smaller, Threaded Ends; Class 150
  - .1 Bronze, Class 150, 150 psi (1035 kPa) steam, 300 psi (2070 kPa) cold working pressure, with solid wedge disc, rising stem, to MSS SP-80.
  - .2 Service: Heating, chilled water,.

- .3 Acceptable material:
  - .1 Crane 431
  - .2 Jenkins 2810J
  - .3 Kitz #42
  - .4 Toyo 298
  - .5 Approved Equivalent
- .2 Ball Valves
  - .1 Bronze body, two piece with threaded or solder ends, 150 psi (1035 kPa) steam, 400 psi (2760 kPa) cold working pressure, PTFE seat and packing, lever handwheel to ASTM B62. Provide stem extensions to suit insulation thickness.
  - .2 Service: Heating, domestic hot water.
    - .1 Acceptable material:
      - .1 Crane 9202/9222.
      - .2 Jenkins 901J/902J
      - .3 Toyo 5044A/5049
      - .4 Kitz 58/59
      - .5 Apollo 70-100/200
      - .6 MAS B-3/B-4
      - .7 Approved Equivalent
- .3 Check Valves
  - .1 Check Valves: 3" (75 mm) and smaller, Threaded Ends; Class 125
    - .1 Class 125, bronze body, bronze disc, screwed cap, regrind seating, to MSS SP-80.
    - .2 Service: Heating, chilled water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 37
      - .2 Jenkins 4092J
      - .3 Toyo 236
      - .4 Kitz 22
      - .5 Milwaukee 509
      - .6 Approved Equivalent
  - .2 Check Valves: 3" (75 mm) and Smaller, Solder Ends; Class (200 CWP)
    - .1 200 CWP, bronze body, bronze disc, to MSS SP-80.
    - .2 Service: Domestic hot and cold water.
    - .3 Acceptable material:
      - .1 Crane 1342
      - .2 Jenkins 4093J
      - .3 Toyo 237
      - .4 Kitz 23
      - .5 Milwaukee 1509
      - .6 Approved Equivalent
  - .3 Check Valves: 2" (50 mm) and Larger, Flanged Ends; Class 125
    - .1 Cast iron, Class 125, with bronze rotating disc, renewable bronze seat rings, bolt-on cover, flanged ends, to MSS SP-71.



- .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
- .3 Acceptable material:
  - .1 Crane 373
  - .2 Jenkins 587J
  - .3 Toyo 435A
  - .4 Kitz 78
  - .5 Milwaukee F-2974-M
  - .6 Approved Equivalent

And/or alternative

- .4 Check Valves: 2" (50 mm) and Larger, Flanged Ends; Class 125
  - .1 Wafer style – cast iron body, M&G W12A-16V, stainless steel trim.
  - .2 Acceptable material:
    - .1 Mueller Steam
    - .2 Crane Duo Chek II
    - .3 Approved Equivalent
  - .5 Check Valves: 3" (75 mm) and Larger, ULC and FM Listed
    - .1 Cast iron, ASTM A126, Class B, 175 psi (1207 kPa) cold working pressure, with bronze disc, bronze replaceable seat ring, flanged ends.
    - .2 Service: Fire protection systems.
    - .3 Acceptable material:
      - .1 Crane 375
      - .2 Jenkins 4777
      - .3 Approved Equivalent
  - .6 Check Valves: 2" (50 mm) and under: threaded ends; Class 300 steam.
    - .1 Acceptable Material:
      - .1 Kitz #19
      - .2 Toyo 360
      - .3 Approved Equivalent
  - .7 Check Valves: 2-1/2" (65 mm) and over: flanged ends; Class 300 steam.
    - .1 Acceptable Material:
      - .1 Kitz 300 SCOS.
      - .2 Bonney Forge 3-61-RF
      - .3 Approved Equivalent- .4 Globe Valves
  - .1 Globe Valves: 3" (75 mm) and Smaller, Threaded Ends; Class 125
    - .1 Class 125, bronze body, teflon disc, union bonnet up to 2" (50 mm) size, bolted bonnet on 2½" and 3" (65 mm and 75 mm), to MSS SP-80.
    - .2 Service: Heating, chilled water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 5
      - .2 Jenkins 106BJ
      - .3 Toyo 220
      - .4 Kitz 03

- .5 Milwaukee 590
  - .6 Approved Equivalent
- .2 Globe Valves : 2" (50 mm) and Smaller, Solder Ends; 300 CWP
  - .1 Bronze body, Teflon disc, screwed bonnet, to MSS SP-80.
  - .2 Service: domestic hot and cold water.
  - .3 Acceptable material:
    - .1 Crane 1310
    - .2 Jenkins 106 BPJ
    - .3 Toyo 222
    - .4 Kitz 10
    - .5 Milwaukee 1590
    - .6 Approved Equivalent
- .3 Globe Valves: 2" (50 mm) and Larger, Flanged Ends; Class 125
  - .1 Cast iron, Class 125, OS&Y, bronze discs, renewable seat ring, to MSS SP-85.
  - .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 351
    - .2 Jenkins 2342J
    - .3 Toyo 400A
    - .4 Kitz 76
    - .5 Milwaukee, F-2981-M
    - .6 Approved Equivalent
- .4 Globe Valves: 3" (75 mm) and Smaller, Threaded Ends; Class 300
  - .1 Class 300, bronze body, 450 Brinell hardened stainless plug-type seating, to MSS SP-80.
  - .2 Service: Heating, chilled water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 382P
    - .2 Jenkins 592J
    - .3 Kitz #17S
    - .4 Toyo #335
    - .5 Approved Equivalent
- .5 Globe Valves: 2" (50 mm) and Larger, Flanged Ends; Class 300
  - .1 Carbon steel to ASTM A216, OS&Y.
  - .2 Acceptable material:
    - .1 Crane 151XU
    - .2 Kitz 300 SCJ
    - .3 Bonney Forge 3-31-RF
    - .4 Approved Equivalent

- .5 Lubricated Plug Valves (where is this used in fire protection? If not needed delete)
  - .1 Lubricated Plug Valve, 2" (50 mm) and Smaller
    - .1 Cast iron body and plug, ASTM A126, Class B, Teflon seals, threaded ends, CGA certified to CAN/CGA-3.11-M88.
    - .2 Service: Natural Gas
    - .3 Acceptable material:
      - .1 Homestead 601, as supplied by Crane Supply
      - .2 Neo Valves PR 1AR40034
      - .3 Approved Equivalent

OR

- .2 Lubricated Plug Valve, 2" (50 mm) and Smaller
  - .1 Ball valve – CGA certified to CGA-3.16 M85.
  - .2 Acceptable material:
    - .1 Kitz #58
    - .2 Crane #9302
    - .3 Toyo 5044A
    - .4 Approved Equivalent
- .3 Lubricated Plug Valve, 2½" (65 mm) and Larger
  - .1 Cast iron body and plug, ASTM A126, Class B, Teflon seals, flanged ends, CGA certified to CAN/CGA-3.11 – M88.
  - .2 Service: Natural Gas
  - .3 Acceptable material:
    - .1 Homestead 602, as supplied by Crane Supply.
    - .2 Neo Valve PR 1AR 40114
    - .3 Kitz 150 SC TAM-FS-N
    - .4 Approved Equivalent
- .6 Butterfly Valves
  - .1 Butterfly Valves: 2" to 4" (50 mm to 100 mm), Lug Body
    - .1 Class 200 CWP, cast iron body to ASTM 126, Class B, aluminum bronze disc, EPDM liner, 416 stainless steel stems, 10 position hand release lock lever handle operator, to MSS SP-67.
    - .2 Service: Heating, chilled water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 44BXZ-L
      - .2 Jenkins 2232 ELJ
      - .3 Mueller Steam 66M
      - .4 Kitz 6122-EL
      - .5 Apollo 143
      - .6 Approved Equivalent
      - .7

- .2 Butterfly Valves: 2" to 4" (50 mm to 100 mm) Wafer Body
  - .1 Class 200 CWP, cast iron body to ASTM 126, Class B, aluminum bronze disc, EPDM liner, 416 stainless steel stems, 10 position hand release lock lever handle operator, to MSS SP-67.
  - .2 Service: Heating, chilled water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 42 BXZ-L
    - .2 Jenkins 2222 ELJ
    - .3 Mueller Steam 65M
    - .4 Kitz 5122-EL
    - .5 Apollo 141
    - .6 Approved Equivalent
- .3 Butterfly Valves: 6" (150 mm) and Larger, Lug Body
  - .1 Class 200 CWP, cast iron body to ASTM 126, Class B, aluminum bronze disc, EPDM liner, 416 stainless steel stems, self-locking gear operator with handwheel, to MSS SP-67.
  - .2 Service: Heating, chilled water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 44BXZ-G
    - .2 Jenkins 2232 EGJ
    - .3 Kitz 6122-EG
    - .4 Apollo 143
    - .5 Approved Equivalent
- .4 Butterfly Valves: 6" (150 mm) and Larger, Wafer Body
  - .1 Class 200 CWP, cast iron body to ASTM 126, Class B, aluminum bronze disc, EPDM liner, 416 stainless steel stems, self-locking gear operator with handwheel, to MSS SP-67.
  - .2 Service: Heating, chilled water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 42 BXZ-G
    - .2 Jenkins 2222 EGJ
    - .3 Kitz 5122-EG
    - .4 Apollo 141
    - .5 Approved Equivalent

## 2.12 STRAINERS AND AIR VENTS

- .1
  - .1 50 mm and smaller with iron body, (bronze for domestic water service), screwed connections, Y-pattern, 1380 kPa WOG and 20-mesh 304 stainless steel screen.
    - .1 Acceptable products:
      - .1 Crane or equal
  - .2 Larger than 50 mm with iron body (bronze for domestic water service), flanged connections, Y-pattern, 1380 kPa W/G and 20-mesh Monel or stainless steel screen.
    - .1 Acceptable products:
      - .1 Crane or equal
  - .3 Provide strainers on upstream side of, pumps, control valves, and where

indicated.

- .2
  - .1 Float type air vents with brass body and NPS ½ connection, 1035 kPa rating.
    - .1 Acceptable products:
      - .1 Amtrol or equal.
    - .2 Provide air vents at high points of heating and cooling water distribution systems, including risers complete with isolation valve.
    - .3 Provide vacuum breaker at tope of each cold water, heating and cooling system riser, and drain valve at bottom.
      - .1 Acceptable products:
        - .1 Watts or equal
    - .4 Provide centrifugal type air eliminators on hydronic systems where indicated on the system schematic drawing.
      - .1 Acceptable products:
        - .1 Spirovent or equal.

## 2.13 FIRE STOP SYSTEMS

- .1 General Purpose Fire Stopping Sealant: Water based, nonslumping, premixed sealant with intumescent properties, rated for 3 hours to ASTM E814, UL 1479.
  - .1 Product: [REDACTED], manufactured by Hilti.
- .2 DWV Plastic Pipe Systems Fire Stopping Sealant: Silicone based, premixed sealant with intumescent properties, vibration and moisture resistant, rated for three (3) hours per [ASTM E814] [UL 1479] with metal collars.
  - .1 Product: [REDACTED], manufactured by Hilti.

## Part 3 Execution

### 3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that excavations are to required grade, dry, and not over-excavated.

### 3.2 PREPARATION

- .1 Ream pipe and tube ends. Remove burrs. [Bevel plain end ferrous pipe].
- .2 Remove scale and dirt, on inside and outside, before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

### 3.3 INSTALLATION

- .1 Install to manufacturer's written instructions.
- .2 Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- .3 Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- .4 Install piping to maintain headroom, conserve space, and not interfere with use of space.
- .5 Group piping whenever practical at common elevations.

- .6 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- .7 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.
- .8 Provide access where valves and fittings are not exposed. [Coordinate size and location of access doors with Section 08 31 13].
- .9 Establish elevations of buried piping outside the building to ensure not less than 1 m cover.
- .10 Install vent piping penetrating roofed areas to maintain integrity of roof assembly. Roof spindles by Roofing Contractor.
- .11 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- .12 Provide support for utility meters to requirements of utility companies.
- .13 Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 10.
- .14 Excavate to Sections 31 23 33 for work of this Section.
- .15 Backfill to Sections 31 23 33 for work of this Section.
- .16 Install bell and spigot pipe with bell end upstream.
- .17 Install valves with stems upright or horizontal, not inverted.
- .18 Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- .19 Install water piping to ASME B31.9.
- .20 Install fuel oil piping to ASME B31.9, ASME B31.1/B31.3.
- .21 Sleeve pipes passing through partitions, walls and floors.
- .22 Inserts:
  - .1 Provide inserts for placement in concrete formwork.
  - .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - .3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 100 mm.
  - .4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- .23 Pipe Hangers and Supports:
  - .1 Install to ASME B31.9, ASTM F708, [MSS SP-58.
  - .2 Support horizontal piping as scheduled.
  - .3 Install hangers to provide minimum 15 mm space between finished covering and adjacent work.
  - .4 Place hangers within 300 mm of each horizontal elbow.
  - .5 Use hangers with 40 mm minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - .6 Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - .7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

- .8 Provide copper plated hangers and supports for copper piping or sheet lead packing between hanger or support and piping.
- .9 Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- .10 Provide hangers adjacent to motor driven equipment with vibration isolation.
- .11 Support cast iron drainage piping as per OBC.

### 3.4 APPLICATION

- .1 Use grooved mechanical couplings and fasteners only in accessible locations.
- .2 Install unions downstream of valves and at equipment or apparatus connections.
- .3 Install gate, ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- .4 Install globe, ball or butterfly valves for throttling, bypass, or manual flow control services.
- .5 Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.
- .6 Provide spring loaded check valves on discharge of water pumps.
- .7 Provide plug valves in natural gas systems for shut-off service.
- .8 Provide flow controls in water recirculating systems where indicated.

### 3.5 ERECTION TOLERANCES

- .1 Section 01 73 00: Execution
- .2 Establish invert elevations, slopes for drainage to 2% or 1% minimum. Maintain gradients.
- .3 Slope water piping minimum 0.25% and arrange to drain at low points.

### 3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- .1 Disinfect water distribution system to Section 23 25 00.
- .2 Prior to starting work, verify system is complete, flushed and clean.
- .3 Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15% of outlets.
- .4 Maintain disinfectant in system for twenty-four (24) hours.
- .5 If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- .6 Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- .7 Take samples no sooner than twenty-four (24) hours after flushing, from 2% of outlets and from water entry, and analyze to AWWA C651.

### 3.7 SERVICE CONNECTIONS

- .1 Provide new water service complete with approved reduced pressure, double check, backflow preventer and water meter, pressure reducing valve as required.
  - .1 Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

END OF SECTION



**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Roof and floor drains.
- .2    Cleanouts.
- .3    Hose bibs.
- .4    Backflow preventers.
- .5    Water hammer arrestors.
- .6    Interceptors.
- .7    Thermostatic mixing valves.

**1.2            RELATED SECTIONS**

- .1    Section 22 10 00 - Plumbing Piping.
- .2    Section 22 42 02 - Plumbing Fixtures.

**1.3            REFERENCES**

- .1    AWWA C510-07 - Double Check Valve Backflow Prevention Assembly.]
- .2    AWWA C511-07 - Reduced-Pressure Principle Backflow Prevention Assembly.]
- .3    ASSE (Plumbing) 1011-2004 - Performance Requirements for Hose Connection Vacuum Breakers.
- .4    ASSE (Plumbing) 1012-2009 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
- .5    ASSE (Plumbing) 1013-2011 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
- .6    ASSE (Plumbing) 1019-2011 - Performance Requirements for Wall Hydrants with Backflow Protection and Freeze Resistance.
- .7    PDI-G 101-2010 - Testing and Rating Procedure for Hydro Mechanical Grease Interceptors with Appendix of Installation and Maintenance.
- .8    PDI-WH 201-2010 - Water Hammer Arrestors.

**1.4            SUBMITTALS FOR REVIEW**

- .1    Section 01 33 00: Submission procedures.
- .2    Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- .3    Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

**1.5            SUBMITTALS FOR INFORMATION**

- .1    Section 01 33 00: Submission procedures.
- .2    Certificates: Certify that [grease] [oil] interceptors meet or exceed [specified requirements].

- .3 Installation Data: Manufacturer's special installation requirements including assembly and support requirements.

## **1.6 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 10: Submission procedures.
- .2 Operation Data: Indicate frequency of treatment required for interceptors.
- .3 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

## **1.7 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 3 years experience.

## **1.8 DELIVERY, STORAGE, AND PROTECTION**

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Accept specialties on site in original factory packaging. Inspect for damage.

# **Part 2 Products**

## **2.1 ROOF DRAINS**

- .1 Manufacturers:
  - .1 Watts; Product: RD-100
  - .2 Approved Equivalent
- .2 Lacquered cast iron drain with deep sump, removable polyethylene domed strainer [with vandal proof screws] and including the following accessories.
  - .1 Membrane flange and membrane clamp with integral gravel stop.
  - .2 Adjustable under deck clamp.
  - .3 Roof sump receiver.
  - .4 Waterproofing flange.
  - .5 Adjustable extension sleeve for roof insulation.

## **2.2 FLOOR DRAINS**

- .1 Floor Drain (FD-1): Strainer standard polished nickel bronze in finished areas, galvanized or lacquered cast iron in service areas and equipment rooms, primer tapping epoxy coated cast iron body, integral seepage pan with flange, clamping collar and adjustable head. 125 mm Diameter
  - .1 Manufacturers:
    - .1 Watts; Product: FD-100-C-A
    - .2 Approved Equivalent
- .2 Scupper (Pit) Drain (SD-1): Epoxy coated, cast iron pit type drain with removable backwater valve and seat.
  - .1 Manufacturers:

- .1 Watts; Product: BV-600
- .2 Approved Equivalent

- .3 Hub Drain (HD-1): Epoxy coated cast iron, anchor flange, reversible membrane clamp with primary and secondary weep holes, adjustable nickel bronze hub funnel and MJ outlet

- .1 Manufacturers:
  - .1 Watts;
  - .2 Approved Equivalent

## 2.3 CLEANOUTS

- .1 Cleanout (CO-1): Round, epoxy coated, cast iron with anchor flange, reversible membrane clamp, adjustable combined nickel-bronze access cover and plug with gasket seal.

- .1 Manufacturers:
  - .1 Watts; Product: CO-100-C-R
  - .2 Approved Equivalent

## 2.4 HOSE BIBS

- .1 Interior: Brass with integral mounting flange, handwheel, replaceable hexagonal disc, hose thread spout, and integral vacuum breaker to [ASSE 1011].

- .1 Manufacturers:
  - .1 Watts; Product: HB-1
  - .2 Approved Equivalent

## 2.5 BACK WATER VALVES

- .1 Cast Iron: Lacquered or Galvanized cast iron body and cover, brass valve, 150 mm extension sleeve] and access cover.
- .2 Plastic: ABS or PVC body and valve, 150 mm extension sleeve and access cover.

## 2.6 BACKFLOW PREVENTERS

- .1 Reduced Pressure Backflow Preventers: ASSE 1013, AWWA C510, AWWA C511, bronze body with bronze internal parts and stainless steel springs, two (2) independently operating, spring loaded check valves and diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure.
  - .1 Non-threaded vent outlet.
  - .2 Assembled with two (2) gate valves, strainer, and four test cocks.
- .2 Double Check Valve Assemblies: ASSE 1012, AWWA C510, AWWA C511, bronze body with corrosion resistant internal parts and stainless steel springs, with two (2) independently operating check valves with intermediate atmospheric vent.

## 2.7 WATER HAMMER ARRESTORS

- .1 Copper construction with piston type sized to PDI WH-201 and pre-charged suitable for operation in temperature range 33 to 180 degrees F and maximum 150 psi working pressure.

**2.8                SUMPS**

- .1        Cast-in-place concrete sump specified in Section 03 30 00.

**2.9                GREASE INTERCEPTORS**

- .1        Manufacturers:
  - .1        Watts; Product: GI-110-A.
  - .2        Approved Equivalent
- .2        Epoxy coated fabricated steel, removable baffle assembly, integral deep seal trap, non-removable stainless steel, calibrated orifice plate, low pressure grease accumulating chamber and draw off hose. Undercounter, above grade installation
  - .1        Cover: Steel, epoxy coated, with gasket, securing handle,
  - .2        10 gpm flow rate and 40 lb grease capacity.

**2.10              SEDIMENT INTERCEPTORS**

- .1        Manufacturers:
  - .1        Watts; Product:SI-740-M
  - .2        Approved Equivalent
- .2        Epoxy coated fabricated steel body and secured cover with removable perforated sediment bucket, removable perforated baffle and gasketed cover secured by single securing bolt.

**2.11              THERMOSTATIC MIXING VALVES**

- .1        Manufacturers:
  - .1        Watts; Product: LF1170.
  - .2        Approved Equivalent
- .2        Lead free, copper silicon alloy body, copper alloy bellows, integral temperature adjustment, check valve on inlets, volume control shut-off valve on outlet, stem thermometer on outlet and filter washers on inlets.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install to manufacturer's written instructions.
- .2        Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- .3        Encase exterior cleanouts in concrete flush with grade.
- .4        Install floor cleanouts at elevation to accommodate finished floor.
- .5        Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
- .6        Pipe relief from backflow preventer to nearest drain.

- .7 Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to [sinks] [lavatories] [washing machine outlets].
- .8 Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or [ $<20\text{ mm}><<3/4\text{ inch}>>$ ] minimum, and minimum [ $<450\text{ mm}><<18\text{ inches}>>$ ] long.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Water closets.
- .2    Urinals.
- .3    Lavatories.
- .4    Sinks.
- .5    Service sinks.
- .6    Drinking fountains.
- .7    Showers.
- .8    Emergency eye wash/showers.

**1.2            RELATED SECTIONS**

- .1    Section 01 33 00 - Submittal Procedures.
- .2    Section 01 45 00 - Quality Control.
- .3    Section 01 61 00 – Common Product Requirements.
- .4    Section 01 78 00 - Closeout Submittals.
- .5    Section 06 10 00 – Rough Carpentry
- .6    Section 22 10 00 - Plumbing Piping.
- .7    Section 22 42 01 - Plumbing Specialties.

**1.3            REFERENCES**

- .1    ASME A112.6.1M-1997 (R2012) - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- .2    ASME A112.18.1-2012/CSA-B125.1-12 - Plumbing Supply Fittings.
- .3    ASME A112.19.1-2013/CSA B45.2-13 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures.
- .4    ASME A112.19.2-2013/CSA-B45.1-13 - Ceramic Plumbing Fixtures]
- .5    ASME A112.19.3-2008/CSA-B45.4-08 - Stainless Steel Plumbing Fixtures.
- .6    ASME A112.19.5-2011/CSA-B45.15-11 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks.
- .7    ISEA Z358.1-2009 - Emergency Eye Wash and Shower Equipment.
- .8    NFPA 70 - National Electrical Code (NEC), 2014 Edition.
- .9    CSA (Canadian Standards Association).
- .10   UL (Underwriters Laboratories Inc.).

**1.4            SUBMITTALS FOR REVIEW**

- .1    Section 01 33 00: Submission Procedures.

- .2 Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, trim, utility sizes, finishes.
- .3 Samples: Submit samples of lavatory supply fittings, fixtures for colour matching, sets of colour chips for each standard colour as required.

**1.5 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submission procedures.
- .2 Manufacturer's Instructions: Indicate installation methods and procedures.

**1.6 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 10: Submission procedures.
- .2 Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- .3 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.7 MAINTENANCE SUBMITTALS**

- .1 Section 01 78 00: Closeout Submittals

**1.8 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to [ISO 9000] [ISO 14000] certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 3 years experience.

**1.9 MOCK-UP**

- .1 Section 01 45 00: Quality Control
- .2 Provide mock-up of typical bathroom group as required.
- .3 Locate where directed by Consultant.
- .4 Approved mock-up may remain as part of the Work.

**1.10 REGULATORY REQUIREMENTS**

- .1 Products Requiring Electrical Connection: Listed and classified by [CSA] [UL] [testing firm acceptable to the authority having jurisdiction] as suitable for the purpose specified and indicated.

**1.11 DELIVERY, STORAGE, AND PROTECTION**

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Accept fixtures on site in factory packaging. Inspect for damage.
- .3 Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

**1.12 WARRANTY**

- .1 Section 01 78 00: Closeout Submittals
- .2 Provide a 1 year warranty to include coverage for failure to meet specified requirements.

**Part 2            Products**

**2.1            FLUSH VALVE WATER CLOSETS**

- .1    Water Closet: ASME A112.19.2/CSA-B45.1, wall hung, vitreous china closet bowl, with elongated rim with 25 mm back spud and china bolt caps.
- .2    Sensor Operated Flush Valve: ASME A112.18.1/CSA-B125.1, concealed rough brass diaphragm type with battery operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker.
  - .1        Maximum Flush Volume: 4.2 L
- .3    Seat: Solid White plastic, open front with extended back, brass bolts, with cover, self-sustaining hinge.
- .4    Wall Mounted Carrier: ASME A112.6.1M, non-adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment and threaded fixture studs with nuts and washers.

**2.2            WALL HUNG URINALS**

- .1    Urinal: ASME A112.19.2/CSA-B45.1, vitreous china, wall hung washout urinal with shields, integral trap, stainless steel strainer, 19 mm back spud; steel supporting hanger.
- .2    Sensor Operated Flush Valve: ASME A112.18.1/CSA-B125.1, concealed rough brass battery operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker.
  - .1        Maximum Flush Volume: 1.9 L
- .3    Wall Mounted Carrier: ASME A112.6.1M], cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger to bearing studs.

**2.3            LAVATORIES**

- .1    Vitreous China Under-Mount Basin: ASME A112.19.2/CSA-B45.1, vitreous china under-mount bathroom lavatory, 543x333x123 mm, without drillings, rear overflow sealed with caulking, or concealed vinyl gasket.
  - .1        Colour: White.
- .2    Metered Faucet: ASME A112.18.1/CSA-B125.1, brass metered mixing faucet with battery operated solenoid operator and infrared sensor, [aerator] [spray] and cover plate, open grid strainer.
  - .1        Maximum Flow Rate: 1.9 /min – 30 second max. continual run cycle
- .3    Accessories:
  - .1        Chrome plated P-trap
  - .2        Offset waste with perforated open strainer
  - .3        Screwdriver tops.
  - .4        Flexible supplies.

**2.4            SINKS**

- .1    Single Compartment Sink: ASME A112.19.3/CSA-B45.4, self-rimming and undercoated with Type 302 stainless steel, 20 gauge thick; chromed brass drain, 38 mm diameter with 90 mm crumb cup and tailpiece; ledge back drilled for trim.



- .1 Size: 525x456x200 mm outside dimensions.
- .2 Trim: ASME A112.18.1/CSA-B125.1, Chrome plated brass supply with long swing spout, vandal proof water economy aerator with maximum 1.9 L/min flow; single lever handle.

## 2.5 SHOWERS

- .1 Trim: [ASME A112.18.1/CSA-B125.1], concealed shower supply with pressure balanced, thermostatic mixing valves, integral service stops, bent shower arm with flow control, adjustable spray, ball joint shower head and escutcheon.
  - .1 Flow: Maximum 5.7 L/min flow.
- .2 Shower Head: ASME A112.18.1/CSA-B125.1, chrome plated vandal-proof institutional head with integral wall bracket with built-in 5.7 L/min flow control.

## 2.6 DRINKING FOUNTAINS

- .1 Drinking Fountain: Basin to be constructed from 304 stainless steels with integral drain. Cabinet shall be galvanized steel with granite powder coat. Underside vandal proof cowling, hooded elevated anti-squirt bubbler with stream guard and automatic stream regulator; pushbutton, mounting bracket and screwdriver stop.
  - .1 Colour: Granite Grey

## 2.7 SERVICE SINKS

- .1 Service Sink: Moulded stone bowl, floor mounted, 600 x 600 x 250 mmhigh with 25 mmwide shoulders, vinyl bumper guard and stainless steel strainer.
  - .1 Colour: White
- .2 Trim: ASME A112.18.1/CSA-B125.1, exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
- .3 Accessories:
  - .1 Hose: 1.5 m of 13 mmdiameter plain end reinforced rubber.
  - .2 Hose clamp hanger.
  - .3 Mop hanger.

## 2.8 COMBINATION EMERGENCY SHOWERS

- .1 Emergency Shower: ANSI Z358.1 free standing, non-clogging 200 mm diameter plastic deluge shower head with elbow, 25 mm full flow valve with pull chain and triangular handle 32 mm interconnecting fittings.

## Part 3 Execution

### 3.1 EXAMINATION

- .1 Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- .2 Verify that electric power is available and of the correct characteristics.
- .3 Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

**3.2 PREPARATION**

- .1 Rough-in fixture piping connections to minimum sizes indicated in fixture rough-in schedule for particular fixtures.

**3.3 INSTALLATION**

- .1 Install to manufacturer's written instructions.
- .2 Install each fixture with trap, easily removable for servicing and cleaning.
- .3 Provide chrome plated rigid or flexible supplies to fixtures with [loose key] [screwdriver] stops, reducers, and escutcheons.
- .4 Install components level and plumb.
- .5 Install and secure fixtures in place with [wall supports] [wall carriers] and bolt, washer, nut fasteners.
- .6 Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 92 00, colour to match fixture.
- .7 Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

**3.4 INTERFACE WITH OTHER PRODUCTS**

- .1 Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

**3.5 ADJUSTING**

- .1 Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

**3.6 PROTECTION OF FINISHED WORK**

- .1 Protecting installed work by others.
- .2 Do not permit use of fixtures.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1      Nameplates.
- .2      Tags.
- .3      Pipe Markers.
- .4      Duct Labels

**1.2            RELATED SECTIONS**

- .1      None

**1.3            REFERENCES**

- .1      ASME A13.1-2007 - Scheme for the Identification of Piping Systems.

**1.4            SUBMITTALS FOR REVIEW**

- .1      Section 01 33 00: Submission Procedures.
- .2      Product Data: Provide manufacturers catalogue literature for each product required.
- .3      Identification Information:
  - .1      Submit list of wording, symbols, letter size, and colour coding for mechanical identification.
- .4      Samples: Submit samples as required.

**1.5            SUBMITTALS FOR INFORMATION**

- .1      Section 01 33 00: Submission Procedures.
- .2      Installation Data: Indicate special procedures, and installation.

**1.6            CLOSEOUT SUBMITTALS**

- .1      Section 01 78 00: Submission Procedures.
- .2      Record Documentation: Record actual locations of tagged valves.  
Submit valve chart and schedule, including valve tag number, location, function.

**Part 2           Products**

**2.1            MANUFACTURERS NAMEPLATES**

- .1      Provide metal or plastic nameplate on each piece of equipment, mechanically fastened, complete with raised or recessed letters
- .2      Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

## 2.3 SYSTEM NAMEPLATES

- .1 Description: Laminated three-layer plastic with engraved black letters on light contrasting background colour. 100x40 mm, 8 mm lettering.

## 2.4 TAGS

- .1 Plastic Tags: Laminated three-layer plastic with engraved [black] letters on light contrasting background colour. Tag size minimum 1 ½" square or round.
- .2 Metal Tags: Brass with stamped letters. Tag size minimum 1 ½" square or round.

## 2.5 PIPE MARKERS

- .1 Colour: Conform to ASME A13.1.
- .2 Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

## 2.6 CEILING TAGS

- .1 Description: Plastic with adhesive backing, ¼" diameter and colour coded surface
- .2 Colour code as follows:
  - .1 Yellow - HVAC equipment.
  - .2 Red - Fire dampers/smoke dampers.
  - .3 Green - Plumbing valves.
  - .4 Blue - Heating/cooling valves.

## Part 3 Execution

### 3.1 PREPARATION

- .1 Degrease and clean surfaces to receive adhesive for identification materials.
- .2 Prepare surfaces to Section 09 91 23 for stencil painting.

### 3.2 INSTALLATION

- .1 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- .2 Install tags with corrosion resistant chain.
- .3 Install plastic tape pipe markers complete around pipe or to manufacturer's written instructions.
- .4 Install underground plastic pipe markers below finished grade, directly above buried pipe.
- .5 Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- .6 Identify control panels and major control components outside panels with plastic nameplates.
- .7 Identify valves in main and branch piping with tags.
- .8 Identify air terminal units and radiator valves with numbered tags.

- .9 Tag automatic controls, instruments, and relays.
- .10 Identify piping, concealed or exposed, with plastic tape pipe markers. . Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 ft on straight runs including risers and drops, at each side of penetration of structure or enclosure, and at each obstruction.
- .11 Identify ductwork with flexible plastic markers with adhesive backing. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- .12 Provide ceiling tags to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Testing, adjustment, and balancing of air systems.
- .2 Testing, adjustment, and balancing of hydronic systems.
- .3 Measurement of final operating condition of HVAC systems.

**1.2 RELATED SECTIONS**

- .1 Section 01 45 00 - Quality Control
  - .1 Testing laboratory services.
  - .2 Employment of testing agency and payment for services.
  - .3 Inspection and testing allowances.
- .2 Section 01 78 00 - Closeout Submittals:
  - .1 Starting of Systems.
  - .2 Testing, Adjusting, and Balancing of Systems.

**1.3 REFERENCES**

- .1 AABC-2002 - National Standards for Total System Balance.
- .2 ADC 1062: GRD-84 - Test Code for Grilles, Registers and Diffusers.
- .3 ASHRAE 111-2008 - Testing, Adjusting, and Balancing of Building HVAC Systems.
- .4 NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation Meetings: Convene 1 week before starting work of this section.
- .2 Sequencing: Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.
- .3 Scheduling: Schedule and provide assistance in final adjustment and test of life safety and smoke control systems with Fire Authority.

**1.5 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submission Procedures.
- .2 Submit name of adjusting and balancing agency for approval within [thirty (30)] days after award of Contract.
- .3 Field Reports: Submit procedures for submitting Field Reports.
  - .1 Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - .2 Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
  - .3 Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Consultant and for inclusion in operating and maintenance manuals.

- .4 Provide reports in letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- .5 Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guarantee prior to commencing system balance.
- .4 Test Reports: Indicate data on AABC National Standards for Total System Balance forms containing information indicated in Schedules, NEBB forms and/or forms prepared following ASHRAE 111. Submit data in SI (metric) units.

## **1.6 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Submission Procedures.
- .2 Record Documentation: Record actual locations of flow measuring stations, balancing valves and rough setting.

## **1.7 QUALITY ASSURANCE**

- .1 Perform total system balance to ASHRAE 111, NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems, AABC National Standards for Field Measurement and Instrumentation, Total System Balance as applicable.
- .2 Maintain 1 copy of document on site.
- .3 Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum 3 experience, certified by AABC.
- .4 Perform Work under supervision of NEBB Certified Testing, Balancing and Adjusting Supervisor, registered Professional Engineer experienced in performance of this Work and licensed at the place where the Project is located.

## **Part 2 Products**

### **2.1 AGENCIES**

- .1 Acceptable Agencies:
  - .1 Maxima Technical Services
  - .2 Approved Alternate

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - .1 Systems are started and operating in a safe and normal condition.
  - .2 Temperature control systems are installed complete and operable.
  - .3 Proper thermal overload protection is in place for electrical equipment.
  - .4 Final filters are clean and in place. If required, install temporary media in addition to final filters.
  - .5 Duct systems are clean of debris.
  - .6 Fans are rotating correctly.

- .7 Fire and volume dampers are in place and open.
- .8 Air coil fins are cleaned and combed.
- .9 Access doors are closed and duct end caps are in place.
- .10 Air outlets are installed and connected.
- .11 Duct system leakage is minimized.
- .12 Hydronic systems are flushed, filled, and vented.
- .13 Pumps are rotating correctly.
- .14 Proper strainer baskets are clean and in place.
- .15 Service and balance valves are open.
- .2 Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
- .3 Beginning of work means acceptance of existing conditions.

### **3.2 PREPARATION**

- .1 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.
- .2 Provide additional balancing devices as required.

### **3.3 INSTALLATION TOLERANCES**

- .1 Air Handling Systems: Adjust to within plus or minus 5% of design for supply systems and plus or minus 10% of design for return and exhaust systems.
- .2 Air Outlets and Inlets: Adjust total to within plus 10% and minus 5% of design to space. Adjust outlets and inlets in space to within plus or minus 10% of design.
- .3 Hydronic Systems: Adjust to within plus or minus 10% of design.

### **3.4 ADJUSTING**

- .1 Ensure recorded data represents actual measured or observed conditions.
- .2 Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- .3 After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- .4 Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- .5 At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- .6 Check and adjust systems approximately six months after final acceptance and submit report.

### **3.5 AIR SYSTEM PROCEDURE**

- .1 Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- .2 Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- .3 Measure air quantities at air inlets and outlets.



- .4 Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- .5 Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- .6 Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- .7 Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- .8 Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50% loading of filters.
- .9 Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- .10 Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- .11 Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- .12 Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
- .13 Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- .14 For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
- .15 On fan powered VAV boxes, adjust air flow switches for proper operation.

### 3.6 WATER SYSTEM PROCEDURE

- .1 Adjust water systems to provide required or design quantities.
- .2 Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- .3 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- .4 Effect system balance with automatic control valves fully open to heat transfer elements.
- .5 Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- .6 Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

574-15  
TOMLINSON Building  
Ottawa, Ontario

Section 23 05 93  
TESTING, ADJUSTING AND BALANCING  
Page 5

END OF SECTION

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Pipe and pipe fittings for:
  - .1       Heating water (and glycol) piping system.
  - .2       Radiant heating piping system.
  - .3       Chilled water piping system.
  - .4       Condenser water piping system.
  - .5       Equipment drains and overflows.
- .2    Valves:
  - .1       Gate valves.
  - .2       Globe or angle valves.
  - .3       Ball valves.
  - .4       Plug valves.
  - .5       Butterfly valves.
  - .6       Check valves.

**1.2            RELATED SECTIONS**

- .1    Section 08 31 00 - Access Doors
- .2    Section 23 05 53 - Mechanical Identification.
- .3    Section 21 07 20 - Thermal Insulation.
- .4    Section 23 25 00 - Chemical Treatment for Piping

**1.3            REFERENCES**

- .1    ASME Boiler and Pressure Vessel Code (BPVC), Section IX-2103 - Welding and Brazing Qualifications.
- .2    ASME B16.3-2011 - Malleable Iron Threaded Fittings: Classes 150 and 300.
- .3    ASME B16.18-2012 - Cast Copper Alloy Solder Joint Pressure Fittings.
- .4    ASME B16.22-2013 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .5    ASME B31.5-2013 - Refrigeration Piping and Heat Transfer Components.
- .6    ASME B31.9-2011 - Building Services Piping.
- .7    ASTM A53/A53M-12 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .8    ASTM A234/A234M-13 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .9    ASTM B32-08 - Standard Specification for Solder Metal.
- .10   ASTM B88M-13 - Standard Specification for Seamless Copper Water Tube.
- .11   ASTM B88-09 - Standard Specification for Seamless Copper Water Tube.
- .12   ASTM D1785-12 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

- .13 ASTM D2235-04(2011) - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- .14 ASTM D2241-09 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- .15 ASTM D2310-06(2012) - Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- .16 ASTM D2466-13 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- .17 ASTM D2467-13a - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- .18 ASTM D2680-01(2009) - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
- .19 ASTM D2683-10e1 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
- .20 ASTM D2751-05 - Standard Specification for Acrylonitrile Butadiene Styrene (ABS) Sewer Pipe and Fittings.
- .21 ASTM D2855-96(2010) - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
- .22 ASTM F477-10 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- .23 ASTM F876-13a - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
- .24 ASTM F877-11a - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems.
- .25 AWS A5.8/A5.8M-2011-AMD 1 - Specification for Filler Metals for Brazing and Braze Welding.
- .26 AWS D1.1/D1.1M-2010 - Structural Welding Code - Steel.
- .27 AWWA C105/A21.5-10 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
- .28 AWWA C110/A21.10-12 - Ductile-Iron and Gray-Iron Fittings for Water.
- .29 AWWA C111/A21.11-12 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .30 AWWA C151/A21.51-09 - Ductile-Iron Pipe, Centrifugally Cast.
- .31 MSS SP-58-2009 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- .32 MSS SP-69-2003 - Pipe Hangers and Supports Selection and Application.

#### 1.4 SYSTEM DESCRIPTION

- .1 Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- .2 Use grooved mechanical couplings and fasteners in accessible locations.

- .3 Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- .4 Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
- .5 Provide pipe hangers and supports to ASTM B31.9 and MSS SP-69 unless indicated otherwise.
- .6 Use ball, gate or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- .7 Use globe, butterfly or ball valves for throttling, bypass, or manual flow control services.
- .8 Use spring loaded check valves on discharge of condenser water pumps.
- .9 Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.
- .10 Use butterfly valves in heating, chilled and/or condenser water systems interchangeably with gate and globe valves.
- .11 Use only butterfly valves in chilled and condenser water systems for throttling and isolation service.
- .12 Use lug end butterfly valves to isolate equipment.
- .13 Use 20 mm, ball, gate valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

#### **1.5 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Include data on pipe materials, pipe fittings, valves, and accessories as required. Provide manufacturers catalogue information, valve data and ratings as required.

#### **1.6 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submission procedures.
- .2 Welders Certificate: Include welders' certification of compliance with AWS D1.1/D1.1M and ASME BPVC-Section IX.
- .3 Installation Data: Manufacturer's special installation requirements including hanging and support methods, joining procedures.

#### **1.7 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Submission procedures.
- .2 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- .3 Record Documentation: Record actual locations of valves, on Valve Schedule.

#### **1.8 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 years experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.
- .4 Welders: Certify to ASME BPVC-Section IX or AWS D1.1/D1.1M.

#### **1.9 REGULATORY REQUIREMENTS**

- .1 Conform to ASME B31.9 code for installation of piping system.
- .2 Welding Materials and Procedures: Conform to applicable provincial labour regulations and ASME BPVC-Section IX.
- .3 Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

#### **1.10 DELIVERY, STORAGE, AND PROTECTION**

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

#### **1.11 ENVIRONMENTAL REQUIREMENTS**

- .1 Ambient Conditions: Do not install underground piping when bedding is wet or frozen.

### **Part 2 Products**

#### **2.1 HEATING WATER AND GLYCOL PIPING, BURIED**

- .1 Pre-Insulated PEX (cross-linked polyethylene) Pipe for Underground/Outdoor Applications (Uponor)
- .2 Steel Pipe: ASTM A53/A53M, Schedule 40, black with AWWA C105 polyethylene jacket, or double layer, half-lapped 0.25 mm polyethylene tape.
  - .1 Fittings: ASTM A234/A234M, forged steel welding type [with double layer, half-lapped 0.25 mm polyethylene tape.
  - .2 Joints: AWS D1.1/D1.1M, welded.
  - .3 Casing: Closed glass cell insulation or Polyurethane insulation with high density polyethylene jacket and heat shrink sleeves.
- .3 Copper Tubing: ASTM B88Type M annealed.
  - .1 Fittings: ASME B16.22, wrought copper.
  - .2 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430-535 degrees F. Braze, AWS A5.8/A5.8M BCuP silver/phosphorus/copper alloy with melting range 1190-1480 degrees F.
  - .3 Casing: Polyurethane insulation with high density polyethylene jacket and heat shrink sleeves. Closed glass cell insulation.

## **2.2 HEATING WATER AND GLYCOL PIPING, ABOVE GROUND**

- .1 Steel Pipe: ASTM A53/A53M, Schedule 40, black.
  - .1 Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type fittings.
  - .2 Joints: Threaded, or AWS D1.1/D1.1M, welded.
- .2 Copper Tubing: ASTM B88M, Type M and DWV] hard drawn.
  - .1 Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
  - .2 Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
  - .3 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430-535 degrees F. Braze, AWS A5.8/A5.8M BCuP silver/phosphorus/copper alloy with melting range 1190-1480 degrees F.

## **2.3 CHILLED WATER PIPING, BURIED**

- .1 Pre-Insulated PEX (cross-linked polyethylene) Pipe for Underground/Outdoor Applications (Uponor)
- .2 Steel Pipe: ASTM A53/A53M, Schedule 40, black with AWWA C105 polyethylene jacket, or double layer, half-lapped 0.25 mm polyethylene tape.
  - .1 Fittings: ASTM A234/A234M, forged steel welding type with double layer, half-lapped 0.25 mm polyethylene tape.
  - .2 Joints: AWS D1.1/D1.1M, welded.
  - .3 Casing: Closed glass cell insulation Polyurethane insulation with high density polyethylene jacket and heat shrink sleeves].
- .3 Copper Tubing: ASTM B88M, ASTM B88, Type M, annealed.
  - .1 Fittings: ASME B16.22, wrought copper.
  - .2 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430-535 degrees F. Braze, AWS A5.8/A5.8M BCuP silver/phosphorus/copper alloy with melting range 1190-1480 degrees F.
  - .3 Casing: Polyurethane insulation with high density polyethylene jacket and heat shrink sleeves. Closed glass cell insulation.
- .4 Ductile Iron Pipe: AWWA C151/A21.51.
  - .1 Fittings: AWWA C110/A21.10, ductile iron, standard thickness.
  - .2 Joints: AWWA C111/A21.11, rubber gasket with 19 mm diameter rods.
- .5 PVC Pipe: ASTM D1785, Schedule 40, or[ASTM D2241, SDR 21 or 26.
  - .1 Fittings: ASTM D2467, ASTM D2466, PVC.
  - .2 Joints: ASTM D2855, solvent weld.
- .6 FRP Pipe: ASTM D2310, fibreglass reinforced thermosetting resin plastic.
  - .1 Fittings: Fibreglass reinforced epoxy.
  - .2 Joints: Hub-and-spigot with rubber gasket or Non-threaded, union or flanged coupling.

## **2.4 CHILLED WATER PIPING, ABOVE GRADE**

- .1 Steel Pipe: ASTM A53/A53M, Schedule 40, black.

- .1 Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type.
- .2 Joints: Threaded or AWS D1.1/D1.1M welded.
- .2 Copper Tubing: ASTM B88M, ASTM B88, Type M and DWV, hard drawn.
  - .1 Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
  - .2 Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
  - .3 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 420-535 degrees F. Braze, AWS A5.8/A5.8M BCuP silver/phosphorus/copper alloy with melting range 1190-1480 degrees F.
- .3 PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
  - .1 Fittings: ASTM D2467 or ASTM D2466, PVC.
  - .2 Joints: ASTM D2855, solvent weld.
- .4 FRP Pipe: ASTM D2310, fibreglass reinforced thermosetting resin plastic.
  - .1 Fittings: Fibreglass reinforced epoxy.
  - .2 Joints: Non-threaded, union or flanged coupling or Hub-and-spigot with rubber gasket.

## 2.5 RADIANT HEATING PIPING

- .1 Copper Tubing: ASTM B88M><ASTM B88, Type M annealed.
  - .1 Fittings: ASME B16.22, wrought copper.
  - .2 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430-535 degrees F. Braze, AWS A5.8/A5.8M BCuP silver/phosphorus/copper alloy with melting range 1190-1480 degrees F.
- .2 Polybutylene Pipe: 100 psig] at 180 degrees F and 200 psig at 73 degrees F, grey or black colour.
  - .1 Fittings: Brass or copper.
  - .2 Joints: Mechanical compression fittings or insert fittings with copper compression rings.
- .3 Polyethylene Pipe: ASTM F877, ASTM F876, cross-linked polyethylene, 100 psig operating pressure at 180 degrees F.
  - .1 Fittings: Brass and copper.
  - .2 Joints: Mechanical compression fittings.
- .4 Composite Polyethylene Pipe: Aluminum tube laminated between two (2) layers of cross-linked polyethylene, 125 psig operating pressure at maximum 180 degrees F.
  - .1 Fittings: Brass flared compression.
  - .2 Joints: Fittings adapt to copper tubing or copper tube fittings, threaded pipe and fittings, and copper compression fittings.
- .5 Hose: Composite hose with nitrile liner, braided fibre reinforcing, neoprene cover, 150 psig operating pressure at 205 degrees F.
  - .1 Fittings: Copper.
  - .2 Joints: Nipple with stainless steel clamp.



## **2.6 EQUIPMENT DRAINS AND OVERFLOWS**

- .1 Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized.
  - .1 Fittings: Galvanized cast iron, or ASME B16.3, malleable iron.
  - .2 Joints: Threaded, or grooved mechanical couplings.
- .2 Copper Tubing: ASTM B88M, ASTM B88, Type M and DWV, hard drawn.
  - .1 Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
  - .2 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F].
- .3 PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
  - .1 Fittings: ASTM D2467, ASTM D2466, PVC.
  - .2 Joints: ASTM D2855, solvent weld.
- .4 ABS Pipe: ASTM D2751, ASTM D2680.
  - .1 Fittings: ASTM D2751.
  - .2 Joints: ASTM D2235, solvent weld.

## **2.7 PIPE HANGERS AND SUPPORTS**

- .1 Conform to ASME B31.9, MSS SP-69, ASTM F708, MSS SP-58.
- .2 Hangers for Pipe Sizes 13 to 100 mm: Carbon steel, adjustable swivel, split ring.
- .3 Hangers for Hot Pipe Sizes 150 mm and Over: Adjustable steel yoke, cast iron roll, double hanger.
- .4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- .5 Multiple or Trapeze Hangers for Hot Pipe Sizes 150 mm and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
- .6 Wall Support for Pipe Sizes to 76 mm: Cast iron hook.
- .7 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .8 Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- .9 Inserts: Malleable iron case of [galvanized] steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## **2.8 UNIONS, FLANGES, AND COUPLINGS**

- .1 Unions for Pipe 50 mm and Under:
  - .1 Ferrous Piping: 150 psig, malleable iron, threaded.
  - .2 Copper Pipe: Bronze, soldered joints.
- .2 Flanges for Pipe Over 50 mm:
  - .1 Ferrous Piping: 150 psig, forged steel, slip-on.
  - .2 Copper Piping: Bronze.
  - .3 Gaskets: 1.6 mm thick preformed neoprene.
- .3 Grooved and Shouldered Pipe End Couplings:
  - .1 Housing Clamps: Malleable iron or galvanized to engage and lock, designed to permit some angular deflection, contraction, and expansion.

- .2 Sealing Gasket: C-shape elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.
- .3 Accessories: Steel bolts, nuts, and washers.
- .4 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

## 2.9 VALVES

- .1 Gate Valves:
  - .1 Gate Valves: 2" (50 mm) and Smaller, Threaded Ends Class 125
    - .1 Class 125, bronze body, solid wedge disc, screwed bonnet, rising stem, to MSS SP-80.
    - .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 428
      - .2 Jenkins 810J
      - .3 Kitz 24
      - .4 Toyo 293
      - .5 Milwaukee 148
      - .6 Approved Equivalent
  - .2 Gate Valves: 2" (50 mm) and Smaller, Solder Ends; Class 125
    - .1 Class 125 bronze body, solid wedge disc, screwed bonnet, rising stem, to MSS SP-80.
    - .2 Service: Domestic hot and cold water.
    - .3 Acceptable material:
      - .1 Crane 1334
      - .2 Jenkins 813J
      - .3 Kitz 44
      - .4 Toyo 299
      - .5 Milwaukee 149
      - .6 Approved Equivalent
  - .3 Gate Valves: 2½" (65 mm) and larger; Class 125, Mechanical Rooms
    - .1 Cast iron, ASTM A126, Class B, with solid wedge disc, bolted bonnet, OS&Y, flanged ends, to MSS SP-70.
    - .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 465½
      - .2 Jenkins 454J
      - .3 Kitz 72
      - .4 Toyo 421A
      - .5 Milwaukee F-2885-M
      - .6 Approved Equivalent

- .4 Gate Valves: 2½ (65 mm) and larger, Class 125, Locations Other than Mechanical Rooms
  - .1 Cast iron, ASTM A136, Class B, with solid wedge disc, bolted bonnet, non-rising stem, flanged ends, to MSS SP-70.
  - .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 461
    - .2 Jenkins 452J
    - .3 Kitz 75
    - .4 Toyo 415 A
    - .5 Milwaukee F-2882-M
    - .6 Approved Equivalent
- .5 Gate Valves: 2" (50 mm) and Smaller, ULC and FM Listed
  - .1 Bronze, Class 150, solid wedge disc, OS&Y, screwed ends, to MSS SP-80.
  - .2 Service: Fire protection systems.
  - .3 Acceptable material:
    - .1 Crane 459
    - .2 Jenkins 275J
    - .3 Approved Equivalent.
- .6 Gate Valves: 2½" (65 mm) and Larger, ULC and FM Listed
  - .1 Cast iron, ASTM A126, Class B, 175 psi (1207 kPa) cold working pressure, with solid wedge disc, bolted bonnet, OS&Y, flanged ends, to MSS SP-70.
  - .2 Service: Fire protection systems
  - .3 Acceptable material:
    - .1 Crane 467C
    - .2 Jenkins 825J
    - .3 Approved Equivalent
- .7 Gate Valves: 2" (50 mm) and smaller, Threaded Ends; Class 150
  - .1 Bronze, Class 150, 150 psi (1035 kPa) steam, 300 psi (2070 kPa) cold working pressure, with solid wedge disc, rising stem, to MSS SP-80.
  - .2 Service: Heating, chilled water,.
  - .3 Acceptable material:
    - .1 Crane 431
    - .2 Jenkins 2810J
    - .3 Kitz #42
    - .4 Toyo 298
    - .5 Approved Equivalent
- .2 Ball Valves
  - .1 Bronze body, two piece with threaded or solder ends, 150 psi (1035 kPa) steam, 400 psi (2760 kPa) cold working pressure, PTFE seat and packing, lever handwheel to ASTM B62. Provide stem extensions to suit insulation thickness.

- .2 Service: Heating, domestic hot water.
  - .1 Acceptable material:
    - .1 Crane 9202/9222.
    - .2 Jenkins 901J/902J
    - .3 Toyo 5044A/5049
    - .4 Kitz 58/59
    - .5 Apollo 70-100/200
    - .6 MAS B-3/B-4
    - .7 Approved Equivalent
- .3 Check Valves
  - .1 Check Valves: 3" (75 mm) and smaller, Threaded Ends; Class 125
    - .1 Class 125, bronze body, bronze disc, screwed cap, regrind seating, to MSS SP-80.
    - .2 Service: Heating, chilled water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 37
      - .2 Jenkins 4092J
      - .3 Toyo 236
      - .4 Kitz 22
      - .5 Milwaukee 509
      - .6 Approved Equivalent
  - .2 Check Valves: 3" (75 mm) and Smaller, Solder Ends; Class (200 CWP)
    - .1 200 CWP, bronze body, bronze disc, to MSS SP-80.
    - .2 Service: Domestic hot and cold water.
    - .3 Acceptable material:
      - .1 Crane 1342
      - .2 Jenkins 4093J
      - .3 Toyo 237
      - .4 Kitz 23
      - .5 Milwaukee 1509
      - .6 Approved Equivalent
  - .3 Check Valves: 2" (50 mm) and Larger, Flanged Ends; Class 125
    - .1 Cast iron, Class 125, with bronze rotating disc, renewable bronze seat rings, bolt-on cover, flanged ends, to MSS SP-71.
    - .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 373
      - .2 Jenkins 587J
      - .3 Toyo 435A
      - .4 Kitz 78
      - .5 Milwaukee F-2974-M
      - .6 Approved Equivalent

And/or alternative

- .4 Check Valves: 2" (50 mm) and Larger, Flanged Ends; Class 125
  - .1 Wafer style – cast iron body, M&G W12A-16V, stainless steel trim.
  - .2 Acceptable material:
    - .1 Mueller Steam
    - .2 Crane Duo Chek II
    - .3 Approved Equivalent
- .5 Check Valves: 3" (75 mm) and Larger, ULC and FM Listed
  - .1 Cast iron, ASTM A126, Class B, 175 psi (1207 kPa) cold working pressure, with bronze disc, bronze replaceable seat ring, flanged ends.
  - .2 Service: Fire protection systems.
  - .3 Acceptable material:
    - .1 Crane 375
    - .2 Jenkins 4777
    - .3 Approved Equivalent
- .6 Check Valves: 2" (50 mm) and under: threaded ends; Class 300 steam.
  - .1 Acceptable Material:
    - .1 Kitz #19
    - .2 Toyo 360
    - .3 Approved Equivalent
- .7 Check Valves: 2-1/2" (65 mm) and over: flanged ends; Class 300 steam.
  - .1 Acceptable Material:
    - .1 Kitz 300 SCOS.
    - .2 Bonney Forge 3-61-RF
    - .3 Approved Equivalent
- .4 Globe Valves
  - .1 Globe Valves: 3" (75 mm) and Smaller, Threaded Ends; Class 125
    - .1 Class 125, bronze body, teflon disc, union bonnet up to 2" (50 mm) size, bolted bonnet on 2½" and 3" (65 mm and 75 mm), to MSS SP-80.
    - .2 Service: Heating, chilled water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 5
      - .2 Jenkins 106BJ
      - .3 Toyo 220
      - .4 Kitz 03
      - .5 Milwaukee 590
      - .6 Approved Equivalent
  - .2 Globe Valves : 2" (50 mm) and Smaller, Solder Ends; 300 CWP
    - .1 Bronze body, Teflon disc, screwed bonnet, to MSS SP-80.
    - .2 Service: domestic hot and cold water.
    - .3 Acceptable material:
      - .1 Crane 1310
      - .2 Jenkins 106 BPJ
      - .3 Toyo 222

- .4 Kitz 10
  - .5 Milwaukee 1590
  - .6 Approved Equivalent
- .3 Globe Valves: 2" (50 mm) and Larger, Flanged Ends; Class 125
  - .1 Cast iron, Class 125, OS&Y, bronze discs, renewable seat ring, to MSS SP-85.
  - .2 Service: Heating, chilled water, domestic hot and cold water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 351
    - .2 Jenkins 2342J
    - .3 Toyo 400A
    - .4 Kitz 76
    - .5 Milwaukee, F-2981-M
    - .6 Approved Equivalent
- .4 Globe Valves: 3" (75 mm) and Smaller, Threaded Ends; Class 300
  - .1 Class 300, bronze body, 450 Brinell hardened stainless plug-type seating, to MSS SP-80.
  - .2 Service: Heating, chilled water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 382P
    - .2 Jenkins 592J
    - .3 Kitz #17S
    - .4 Toyo #335
    - .5 Approved Equivalent
- .5 Globe Valves: 2" (50 mm) and Larger, Flanged Ends; Class 300
  - .1 Carbon steel to ASTM A216, OS&Y.
  - .2 Acceptable material:
    - .1 Crane 151XU
    - .2 Kitz 300 SCJ
    - .3 Bonney Forge 3-31-RF
    - .4 Approved Equivalent
- .5 Lubricated Plug Valves (where is this used in fire protection? If not needed delete)
  - .1 Lubricated Plug Valve, 2" (50 mm) and Smaller
    - .1 Cast iron body and plug, ASTM A126, Class B, Teflon seals, threaded ends, CGA certified to CAN/CGA-3.11-M88.
    - .2 Service: Natural Gas
    - .3 Acceptable material:
      - .1 Homestead 601, as supplied by Crane Supply
      - .2 Neo Valves PR 1AR40034
      - .3 Approved Equivalent

OR

- .2 Lubricated Plug Valve, 2" (50 mm) and Smaller
  - .1 Ball valve – CGA certified to CGA-3.16 M85.
  - .2 Acceptable material:
    - .1 Kitz #58
    - .2 Crane #9302
    - .3 Toyo 5044A
    - .4 Approved Equivalent
  - .3 Lubricated Plug Valve, 2½" (65 mm) and Larger
    - .1 Cast iron body and plug, ASTM A126, Class B, Teflon seals, flanged ends, CGA certified to CAN/CGA-3.11 – M88.
    - .2 Service: Natural Gas
    - .3 Acceptable material:
      - .1 Homestead 602, as supplied by Crane Supply.
      - .2 Neo Valve PR 1AR 40114
      - .3 Kitz 150 SC TAM-FS-N
      - .4 Approved Equivalent
- .6 Butterfly Valves
  - .1 Butterfly Valves: 2" to 4" (50 mm to 100 mm), Lug Body
    - .1 Class 200 CWP, cast iron body to ASTM 126, Class B, aluminum bronze disc, EPDM liner, 416 stainless steel stems, 10 position hand release lock lever handle operator, to MSS SP-67.
    - .2 Service: Heating, chilled water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 44BXZ-L
      - .2 Jenkins 2232 ELJ
      - .3 Mueller Steam 66M
      - .4 Kitz 6122-EL
      - .5 Apollo 143
      - .6 Approved Equivalent
      - .7
  - .2 Butterfly Valves: 2" to 4" (50 mm to 100 mm) Wafer Body
    - .1 Class 200 CWP, cast iron body to ASTM 126, Class B, aluminum bronze disc, EPDM liner, 416 stainless steel stems, 10 position hand release lock lever handle operator, to MSS SP-67.
    - .2 Service: Heating, chilled water, condenser water.
    - .3 Acceptable material:
      - .1 Crane 42 BXZ-L
      - .2 Jenkins 2222 ELJ
      - .3 Mueller Steam 65M
      - .4 Kitz 5122-EL
      - .5 Apollo 141
      - .6 Approved Equivalent

- .3 Butterfly Valves: 6" (150 mm) and Larger, Lug Body
  - .1 Class 200 CWP, cast iron body to ASTM 126, Class B, aluminum bronze disc, EPDM liner, 416 stainless steel stems, self-locking gear operator with handwheel, to MSS SP-67.
  - .2 Service: Heating, chilled water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 44BXZ-G
    - .2 Jenkins 2232 EGJ
    - .3 Kitz 6122-EG
    - .4 Apollo 143
    - .5 Approved Equivalent
- .4 Butterfly Valves: 6" (150 mm) and Larger, Wafer Body
  - .1 Class 200 CWP, cast iron body to ASTM 126, Class B, aluminum bronze disc, EPDM liner, 416 stainless steel stems, self-locking gear operator with handwheel, to MSS SP-67.
  - .2 Service: Heating, chilled water, condenser water.
  - .3 Acceptable material:
    - .1 Crane 42 BXZ-G
    - .2 Jenkins 2222 EGJ
    - .3 Kitz 5122-EG
    - .4 Apollo 141
    - .5 Approved Equivalent

## 2.10 SWING CHECK VALVES

- .1 Up To and Including 50 mm:
  - .1 Bronze body, bronze trim, bronze rotating swing disc, with composition disc, threaded or solder ends.
- .2 Over 50 mm:
  - .1 Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

## 2.11 SPRING LOADED CHECK VALVES

- .1 Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

## Part 3 Execution

### 3.1 PREPARATION

- .1 Ream pipe and tube ends. Remove burrs. Remove scale and dirt on inside and outside before assembly.
- .2 Prepare piping connections to equipment with flanges or unions.
- .3 Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- .4 After completion, fill, clean, and treat systems. Refer to Section 23 25 00.



### 3.2 INSTALLATION

- .1 Install to manufacturer's written instructions.
- .2 Install heating water, glycol, and chilled water piping to ASME B31.9. Install chilled water piping to ASME B31.5.
- .3 Route piping in orderly manner, parallel to building structure, and maintain gradient.
- .4 Install piping to conserve building space, and not interfere with use of space.
- .5 Group piping whenever practical at common elevations.
- .6 Sleeve pipe passing through partitions, walls and floors.
- .7 Slope piping and arrange to drain at low points.
- .8 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- .9 Inserts:
  - .1 Provide inserts for placement in concrete formwork.
  - .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - .3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 100 mm.
  - .4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- .10 Pipe Hangers and Supports:
  - .1 Install to ASTM F708, ASME B31.9.
  - .2 Support horizontal piping as scheduled.
  - .3 Install hangers to provide minimum 13 mm space between finished covering and adjacent work.
  - .4 Place hangers within 300 mm of each horizontal elbow.
  - .5 Use hangers with 38 mm minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - .6 Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - .7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - .8 Provide copper plated hangers and supports for copper piping or sheet lead packing between hanger or support and piping.
  - .9 Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- .11 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- .12 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.
- .13 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- .14 Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 91 10.
- .15 Install valves with stems upright or horizontal, not inverted.

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Cleaning of pipe and fittings.
- .2 Chemical feeder equipment.
- .3 Chemical treatment.

**1.2 RELATED SECTIONS**

- .1 Section 23 21 00 - Hydronic Piping

**1.3 REFERENCES**

- .1 CSA (Canadian Standards Association).
- .2 UL (Underwriters Laboratories Inc.).

**1.4 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00: Submission procedures.
- .2 Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
- .3 Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

**1.5 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements including placement of equipment in systems, piping configuration, and connection requirements.
- .3 Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
- .4 Submit certificate of compliance from authority having jurisdiction.
- .5 indicating approval of chemicals and their proposed disposal.

**1.6 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Submission procedures.
- .2 Maintenance Contracts:
  - .1 Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.
  - .2 Provide technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.
  - .3 Provide laboratory and technical assistance services during this maintenance period.

- .4 Include two hour training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start up of systems.
- .5 Provide onsite inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.
- .3 Record Documentation: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.
- .4 Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

## **1.7 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Section 01 78 00: Maintenance and extra material requirements.
- .2 Extra Stock Materials: Provide sufficient chemicals for treatment and testing during warranty period.

## **1.8 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 14000 or ISO 9000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 3 years experience. Company to have local representatives with water analysis laboratories and full time service personnel.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience and approved by the manufacturer.

## **1.9 REGULATORY REQUIREMENTS**

- .1 Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and to public sewage systems.
- .2 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction, UL, CSA as suitable for the purpose specified and indicated.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 System Cleaner:
  - .1 Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
  - .2 Biocide; chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.
- .2 Closed System Treatment (Water):
  - .1 Sequestering agent to reduce deposits and adjust pH; polyphosphate.

- .2 Corrosion inhibitors; liquid boron-nitrite, sodium nitrite and borax, sodium tolyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
- .3 Conductivity enhancers; phosphates or phosphonates.
- .3 Condenser Water System Treatment (Cooling Towers):
  - .1 Sequestering agent to inhibit scaling; phosphonates, sodium polyphosphates, lignin derivatives, synthetic polymer polyelectrolytes, or organite phosphates.
  - .2 Acid to reduce alkalinity and pH; sulphuric acid.
  - .3 Corrosion inhibitor; zinc-phosphate, phosphonate-phosphate, phosphonate-molybdate and phosphonate-silicate, sodium tolyltriazole, or low molecular weight polymers.
  - .4 Biocide; chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quaternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.
- .4 Open System Treatment Humidifiers, Air Washers, Evaporative Condensers, Small Cooling Towers, Liquid Coolers:
  - .1 Sequestering agent to inhibit scaling and corrosion inhibitor; polyphosphate.
  - .2 Biocide; chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quaternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.

## 2.2 BY-PASS (POT) FEEDER

- .1 By-Pass (Pot) Feeder: 6.8 L quick opening cap for working pressure of 175 psig.

## 2.3 SOLUTION METERING PUMP

- .1 Positive displacement, diaphragm pump with adjustable flow rate, thermoplastic construction, continuous-duty fully enclosed electric motor and drive, and built-in relief valve.
- .2 Electrical Characteristics:
  - .1 120 volts, single phase, 60 Hz.
  - .2 Cord and Plug: Provide unit with 2 m cord and plug for connection to electric wiring system including grounding connector.

## 2.4 SOLUTION TANKS

- .1 Solution Tanks: 114 L (30 gal) capacity, polyethylene, self-supporting, 3.8 L (1 gal) graduated markings; moulded fibreglass cover with recess for mounting pump, agitator, and liquid level switch.
  - .1 [ ] rated load amperes.
  - .2 [ ] volts, single phase, 60 Hz.

## 2.5 TEST EQUIPMENT

- .1 Provide white enamel test cabinet with local and fluorescent light, capable of accommodating [ $<0.135$  to  $0.338$  ml] $><<4$  to  $10$  oz $>>]$  zeroing titrating burettes and associated reagents.
- .2 Provide the following test kits:
  - .1 Alkalinity titration test kit.

- .2 Chloride titration test kit.
- .3 Sulphite titration test kit.
- .4 Total hardness titration test kit.
- .5 Low phosphate test kit.
- .6 Conductivity bridge, range 0 - 10,000 microhms.
- .7 Creosol red pH slide complete with reagent.
- .8 Portable electronic conductivity meter.
- .9 High nitrite test kit.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Systems to be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
- .2 Place terminal control valves in open position during cleaning.
- .3 Verify that electric power is available and of the correct characteristics.

### **3.2 CLEANING SEQUENCE**

- .1 Concentration:
  - .1 As recommended by manufacturer.
- .2 Hot Water Heating Systems:
  - .1 Apply heat while circulating, slowly raising temperature 160 degrees F and maintain for twelve (12) hours minimum.
  - .2 Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
  - .3 Circulate for six (6) hours at design temperatures, then drain.
  - .4 Refill with clean water and repeat until system cleaner is removed.
- .3 Chilled Water Systems:
  - .1 Circulate for forty-eight (48) hours, then drain systems as quickly as possible.
  - .2 Refill with clean water, circulate for twenty-four (24) hours, then drain.
  - .3 Refill with clean water and repeat until system cleaner is removed.
- .4 Use neutralizer agents on recommendation of system cleaner supplier and approval of Consultant.
- .5 Flush open systems and glycol filled closed systems with clean water for one (1) hour minimum. Drain completely and refill.
- .6 Remove, clean, and replace strainer screens.
- .7 Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

### **3.3 INSTALLATION**

- .1 Install to manufacturer's written instructions.

**3.4 CLOSED SYSTEM TREATMENT**

- .1 Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.
- .2 Introduce closed system treatment through bypass feeder when required or indicated by test.
- .3 Provide water coupon rack around circulating pumps with space for two test specimens.

**3.5 OPEN SYSTEM TREATMENT – HUMIDIFIERS, AIR WASHERS, EVAPORATIVE CONDENSERS, SMALL COOLING TOWERS, LIQUID COOLERS**

- .1 Provide one glass mesh feeder bag per unit, suspended in sump, filled with sequestering agent.
- .2 Provide 13 mm bleed-off complete with globe valve piped to drain. Locate bleed-off above flood line.

**3.6 CONDENSER WATER SYSTEMS - COOLING TOWERS**

- .1 Provide solution pumps to feed sequestering agent and corrosion inhibitor from solution tank into condenser water supply to tower. Provide agitator as required.
- .2 Provide solution pump to feed diluted acid from solution tank into condenser water supply to tower.
- .3 Introduce algaecide to tower by continuous feed solution pump.
- .4 Provide water meter in make-up water line to tower, to activate solution pumps for preset time when condenser water pumps are running.
- .5 Provide liquid level indicator in each solution tank.
- .6 Provide 19 mm water coupon rack around circulating pumps with space for two test specimens.
- .7 Provide automatic condenser water control systems for inhibitor feed, blowdown and biocide feeds. Meter activate inhibitor application, conductivity activate blowdown, and meter feed biocide with blowdown locked out to ensure biocide retention time.
- .8 Provide solution pumps to feed sequestering agent and corrosion inhibitor from solution tank into condenser water supply to tower. Provide agitator as required.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1    Ductwork and duct fittings.
- .2    Inlet fittings.
- .3    Dust elimination and collection devices.
- .4    Accessories.

**1.2            RELATED SECTIONS**

- .1    Section 26 05 00 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3            REFERENCES**

- .1    ACGIH 2096 - Industrial Ventilation: A Manual of Recommended Practice for Design, 27th Edition.
- .2    AMCA 99-10 - Standards Handbook.
- .3    AMCA 210-07 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .4    AMCA 300-08 - Reverberant Room Method for Sound Testing of Fans.
- .5    AMCA 301-06 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .6    ASTM A167-99(2009) - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .7    ASTM A653/A653M-13 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .8    ASTM A90/A90M-13 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- .9    ASTM A1011/A1011M-13 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- .10   AWS D9.1/D9.1M-2012 - Sheet Metal Welding Code.
- .11   NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particulate Solids, 2010 Edition.
- .12   SMACNA 1966 - HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition (2005).
- .13   SMACNA 1922 - Rectangular Industrial Duct Construction Standard (2004).
- .14   SMACNA 1520 - Round Industrial Duct Construction Standard (1999).
- .15   UL 181-2013 - Standard for Factory-Made Air Ducts and Air Connectors (11th Edition).
- .16   CSA (Canadian Standards Association).
- .17   UL (Underwriters Laboratories Inc.).

**1.4            SUBMITTALS FOR REVIEW**

- .1    Section 01 33 00: Submission procedures.

- .2 Product Data: Provide manufacturers literature and data indicating rated capacities, dimensions, weights and point loadings, accessories, electrical characteristics and connection requirements, wiring diagrams, and location and sizes of field connections.
- .3 Shop Drawings: Indicate dimensions, sizes, weights and point loadings, material thickness, and locations and sizes of field connections

#### **1.5 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submission procedures.
- .2 Provide fan curves with specified operating point clearly plotted.
- .3 Submit sound power levels for both fan inlet and outlet at rated capacity.
- .4 Installation Data: Manufacturer's special installation requirements including assembly and installation instructions.

#### **1.6 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Submission procedures.
- .2 Operation and Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

#### **1.7 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Fans:
  - .1 Performance Ratings: Conform to AMCA
  - .2 Fabrication: Confirm to AMCA 99

#### **1.8 REGULATORY REQUIREMENTS**

- .1 Products Requiring Electrical Connection: Listed and classified by CSA and ULC.

### **Part 2 Products**

#### **2.1 SYSTEMS MANUFACTURERS**

- .1 Manufacturers:
  - .1 Plymovent MDB-4F – Central Filter System with Fan
  - .2 Approved Equivalent

#### **2.2 FANS**

- .1 Manufacturers:
  - .1 Plymovent
  - .2 Approved Equivalent
- .2 Base performance on sea level conditions.
- .3 Performance.
  - .1 Air Flow: 950 – 2200 CFM
  - .2 External Static Pressure: 6.4 – 2.2 inch WG.
  - .3 Motor: 3 hp, 575 volts, three-phase, 60 Hz.



- .4 Wheel and inlet.
  - .1 Radial: Aluminum construction with inlet flange, back plate, plate blades, welded or riveted to back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.
- .5 Housing: Heavy gauge steel, continuously welded with inlet bell and shaped cut-off. Motors and Drives:
  - .1 Motors: As indicated, in compliance with Division 26.
  - .2 Electrical Characteristics: Refer to Section Division 26.
  - .3 Bearings: Heavy duty pillow block type, self aligning, grease-lubricated ball bearings or roller bearings.
  - .4 Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.
  - .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed; variable and adjustable pitch for motors 15 HP and under; matched belts, and rated minimum 1.5 times nameplate rating of motor.

## **2.3 DUCT WORK AND DUCT ACCESSORIES**

- .1 Materials:
  - .1 Galvanized Steel Ducts: ASTM A653/A653M, galvanized steel sheet, lock-forming quality, having zinc coating to ASTM A90/A90M,
- .2 Duct Work.
  - .1 Fabricate and support to SMACNA 1520, SMACNA 1922, UL 181, SMACNA 1966, 2 inch pressure class and ACGIH Industrial Ventilation Manual except as indicated.
  - .2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline.
  - .3 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
  - .4 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA 1966. Prime coat welded joints.
  - .5 Use crimp joints with or without bead for joining round duct sizes 200 mm and smaller with crimp in direction of air flow, with liquid adhesive plus sheet metal screws.
  - .6 Joints: Minimum 100 mm cemented slip type, brazed, or electric welded to AWS D9.1/D9.1M.
  - .7 Provide standard 45 degree lateral wye branch fittings unless otherwise indicated.
  - .8 Use double nuts and lock washers on threaded rod supports.

## **2.4 INLET FITTINGS**

- .1 Fabricate of minimum 1.5 mm, galvanized steel.
- .2 Fabricate with hemmed edges, closed corners, and reinforced for span and attachment; with duct connection.

## **2.5 FILTER SEPARATOR**

- .1 Manufacturers:

- .1 Plymovent MDB-4F – Central Filter System with Fan
- .2 Approved Equivalent
- .2 Indoor dust collector consisting of structural frame and casing, filters, fan and accessories.
- .3 Frame and Casing: Steel frame with electro-zinc coating. 896x1250 mm floor area,
- .4
- .5 Filter: Cylindrical cartridge filters, polyester fibres, 4 of 15 sq. metres, MERV 11
- .6 Accessories: Pressure controlled, automatic cleaning system. Particulates collected in container at bottom of unit.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verify that field measurements are as indicated on Shop Drawings and instructed by the manufacturer.

**3.2 INSTALLATION**

- .1 Install equipment to manufacturers written instructions.
- .2 Do not operate fans for any purpose until filters are in place, bearings lubricated, and fan has been test run under observation.
- .3 Install flexible connections at fan inlet and collector discharge. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan while running.
- .4 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Variable volume terminal units.
- .2 Integral sound attenuator.
- .3 Integral heating coils.
- .4 Integral damper motor operators.
- .5 Integral controls.

**1.2 RELATED SECTIONS**

- .1 Section 23 21 00 - Hydronic Piping: Connections to heating coils.
- .2 Section 23 37 00 - Air Outlets and Inlets.
- .3 Section 25 05 01 – EMCS – General Requirements
- .4 Section 25 90 00 – Sequence of Operations
- .5 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3 REFERENCES**

- .1 ADC 1062: GRD-84 - Test Code for Grilles, Registers and Diffusers.
- .2 NFPA 90A -Standard for Installation of Air Conditioning and Ventilating Systems, 2012 edition.
- .3 UL 181-2013 - Standard for Factory-Made Air Ducts and Air Connectors (11th Edition).
- .4 CSA (Canadian Standards Association).
- .5 UL (Underwriters Laboratories Inc.).

**1.4 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalogue performance ratings which indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
- .3 Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

**1.5 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submittal Procedures.
- .2 Installation Data: Manufacturer's special installation requirements including support and hanging details, and service clearances required.

**1.6 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Submission procedures.

- .2 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists.
- .3 Record Documentation: Record actual locations of units.
- .4 Warranty Documentation.

## **1.7 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 8 years experience.

## **1.8 REGULATORY REQUIREMENTS**

- .1 Products Requiring Electrical Connection: Listed and classified by [testing firm acceptable to the authority having jurisdiction CSA/ULC as suitable for the purpose specified and indicated.

## **1.9 WARRANTY**

- .1 Section 01 78 10: Warranties.
- .2 Provide 1 year warranty, including coverage of operating controls and electric motors.

## **Part 2 Products**

### **2.1 MANUFACTURERS**

- .1 Manufacturers:
  - .1 EH Price
  - .2 Krueger
  - .3 Nailor
  - .4 Approved Equivalent

### **2.2 SINGLE DUCT VARIABLE AIR VOLUME UNITS**

- .1 Ceiling mounted variable air volume supply air control terminals for connection to single duct, central air systems, with DDC variable volume controls and hot water heating coils where applicable.
- .2 Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.
- .3 Basic Assembly:
  - .1 Casings: Minimum 22 gauge galvanized steel.
  - .2 Lining: Minimum 13 mm thick neoprene or vinyl coated fibrous glass insulation, 24 g/L density, meeting NFPA 90A requirements and UL 181 erosion requirements.
  - .3 Plenum Air Inlets: Round collar for field connection
  - .4 Plenum Air Outlets: Rectangular S slip and drive connections.
- .4 Basic Unit:

- .1 Configuration: Air volume damper assembly inside unit casing. Locate control component inside protective metal shroud.
- .2 Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2% of design air flow at 1 inch WG rated] inlet static pressure.
- .3 Mount damper operator to position damper as indicated.
- .5 Attenuator Section: Line attenuator sections with 13 mm thick insulation.
- .6 Hot Water Heating Coil:
  - .1 Construction: 13 mm copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.
  - .2
  - .3 Capacity: Based on 140 degree F entering water, 120 degree F leaving water and 30% total air volume.
- .7 Automatic Damper Operator:
  - .1 Electric Actuator: 24 volt with remote temperature read and reset capability and high limit.
  - .2 Damper Operator: 3-13 psig spring range.
  - .3 Maximum Volume Controller and Probe: Pneumatic, with calibration pressure taps for high flow limited proportional variable air volume control.
  - .4 Velocity Reset Controller and Probe:
    - .1 DDC
    - .2 Calibration pressure taps for pressure independent control to compensate for varying inlet static pressure.
    - .3 Minimum and maximum limits set at reset device.
- .8 Thermostat: Wall-mounted Electronic type with appropriate mounting hardware. Refer to Section 25 05 01 and 25 90 00.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install to manufacturer's written instructions.
- .2 Provide ceiling access doors or locate units above easily removable ceiling components.
- .3 Support units individually from structure. Do not support from adjacent ductwork.
- .4 Connect to ductwork to Section 23 31 00.
- .5 Provide minimum of [ $<1.5\text{ m}><<5\text{ ft}>>$ ] of [ $<25\text{ mm}><<1\text{ inch}>>$ ] [ $<50\text{ mm}><<2\text{ inch}>>$ ] thick lined ductwork downstream of units.
- .6 Install heating coils to Section 23 82 16.
- .7 Verify that electric power is available and of the correct characteristics.

### **3.2 ADJUSTING**

- .1 Adjust work to Section 01 78 10.

- .2 Reset volume with damper operator attached to assembly allowing flow range modulation from 100% of design flow 0% full flow. Set units with heating coils for minimum 30% full flow.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Diffusers.
- .2 Registers/grilles.
- .3 Louvres.

**1.2 REFERENCES**

- .1 ADC 1062: GRD-84 - Test Code for Grilles, Registers and Diffusers.
- .2 AMCA 500-L-12 - Laboratory Methods of Testing Louvers for Rating.
- .3 AMCA 500-D-12 - Laboratory Methods of Testing Dampers for Rating.
- .4 ASHRAE 70-2006 (RA 2011) - Method of Testing the Performance of Air Outlets and Air Inlets.
- .5 NFPA 90A -Standard for Installation of Air Conditioning and Ventilating Systems, 2012 edition.
- .6 SMACNA 1966 - HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition (2005).

**1.3 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- .3 Samples: Submit one of each required air outlet and inlet type as required

**1.4 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Submission procedures.
- .2 Record Documentation: Record actual locations of air outlets and inlets.

**1.6 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 9000 or ISO 14000 certification requirements.
- .2 Test and rate air outlet and inlet performance to [ADC 1062: GRD] [ASHRAE 70].
- .3 Test and rate louvre performance to [AMCA 500-L].
- .4 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum [three (3)] years [documented] experience.

**1.7            MOCK-UP**

- .1      Section 01 45 00: Requirements for mock-up.
- .2      Provide mock-up of typical interior ceiling module with supply and return air outlets, as required
- .3      Locate where directed by Consultant.
- .4      Approved mock-up may remain as part of the Work.

**Part 2            Products**

**2.1            ROUND CEILING DIFFUSERS**

- .1      Manufacturers:
  - .1          NAD-Klima
  - .2          EH Price
  - .3          Nailor
  - .4          Approved Equivalent
- .2      Type: Round, adjustable pattern stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated. Fabrication: Steel with baked enamel [off-white] finish.
- .3      Accessories: Butterfly damper and multi-louvred equalizing grid with damper adjustable from diffuser face.

**2.2            CEILING AND WALLEXHAUST AND RETURN REGISTERS/GRILLES**

- .1      Manufacturers:
  - .1          EH Price
  - .2          Nailor
  - .3          Approved Equivalent
- .2      Type: Streamlined blades, 19 mm minimum depth, 19 mm maximum spacing, with blades set at 45 degrees, horizontal or vertical face.
- .3      Frame: 32 mm to 25 mm margin with countersunk screw mounting.
- .4      Fabrication: Steel with 20 ga minimum frames and 22 ga minimum blades, steel and aluminum with 20 ga minimum frame, or aluminum extrusions, with factory finish and color to be coordinated with Division 09.
- .5      Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

**2.3            CEILING SLOT DIFFUSERS**

- .1      Manufacturers:
  - .1          NAD-Klima
  - .2          EH Price
  - .3          Nailor
  - .4          Approved Equivalent.
- .2      Type: Continuous 32 mm wide slot, one to four slots wide as required, with adjustable vanes for left, right, or vertical discharge.



- .3 Fabrication: Aluminum extrusions with factory powder coated finish and colour to be selected by Division 09.
- .4 Frame: 13 mm margin with support clips for suspension system, concealed mounting.
- .5 Plenum: Integral, galvanized steel, un-insulated.

## **2.4 LOUVRED MECHANICAL PENTHOUSE**

- .1 Manufacturers:
  - .1 Ventex
- .2 Type: 6" Extruded Aluminum, 45 degree at 184 mm centres. MILL Finish

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install to manufacturer's written instructions.
- .2 Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- .3 Install diffusers to duct work with air tight connection.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Related Sections:
  - .1 Section 01 33 00 - Submittal Procedures.
  - .2 Section 01 35 21 – LEED Requirements
  - .3 Section 01 35 29 - Health and Safety Requirements.
  - .4 Section 25 90 00 - Sequences of Operation.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
  - .1 ANSI/ISA 5.5-[1985], Graphic Symbols for Process Displays.
- .2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
  - .1 ANSI/IEEE 260.1-[1993], American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
  - .1 ASHRAE STD 135-[R2001], BACNET - Data Communication Protocol for Building Automation and Control Network.
- .4 Canadian Standards Association (CSA International).
  - .1 CAN/CSA-Z234.1-[89(R1995)], Canadian Metric Practice Guide.
- .5 Consumer Electronics Association (CEA).
  - .1 CEA-709.1-[B-2002], Control Network Protocol Specification.
- .6 Department of Justice Canada (Jus).
  - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
  - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .7 Electrical and Electronic Manufacturers Association (EEMAC).
  - .1 EEMAC 2Y-1-[1958], Light Gray Colour for Indoor Switch Gear.

**1.3 ACRONYMS AND ABBREVIATIONS**

- .1 Acronyms used in EMCS:
  - .1 AEL - Average Effectiveness Level.
  - .2 AI - Analog Input.
  - .3 AIT - Agreement on International Trade.
  - .4 AO - Analog Output.
  - .5 BACnet - Building Automation and Control Network.
  - .6 BC(s) - Building Controller(s).
  - .7 BECC - Building Environmental Control Center.
  - .8 CAD - Computer Aided Design.

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

#### 1.4 DEFINITIONS

- .1 Point: may be logical or physical.
  - .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
  - .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.
- .2 Point Name: composed of two parts, point identifier and point expansion.
  - .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide [25] [ ]

- character field for each point identifier. "System" is system that point is located on.
- .1 Area descriptor: building or part of building where point is located.
  - .2 System descriptor: system that point is located on.
  - .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be short forms or acronyms. Database must provide 25 character field for each point identifier.
- .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
- .1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- .3 Point Object Type: points fall into following object types:
- .1 AI (analog input).
  - .2 AO (analog output).
  - .3 DI (digital input).
  - .4 DO (digital output).
  - .5 Pulse inputs.
- .4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
- .1 Printouts: to ANSI/IEEE 260.1.
  - .2 Refer also to Section [25 05 54- EMCS: Identification] [ ].

## 1.5 SYSTEM DESCRIPTION

- .1 Refer to control schematics and control points list for system architecture.
- .2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:
- .1 Building Controllers.
  - .2 Control devices as listed in I/O point summary tables.
  - .3 Operator Work Station
  - .4 Data communications equipment necessary to effect EMCS data transmission system.
  - .5 Field control devices.
  - .6 Software/Hardware complete with full documentation.
  - .7 Complete operating and maintenance manuals.
  - .8 Training of personnel.
  - .9 Acceptance tests, technical support during commissioning, full documentation.
  - .10 Wiring interface co-ordination of equipment supplied by others.
  - .11 Miscellaneous work as specified in these sections and as indicated.
- .3 Design Requirements:
- .1 Design and provide conduit and wiring linking elements of system.
  - .2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Engineer prior to installation.
  - .3 Location of controllers as reviewed by Engineer prior to installation.
  - .4 Provide utility power to EMCS, and emergency power to EMCS as indicated.

- .5 Metric references: in accordance with CAN/CSA Z234.1.
- .4 Language Operating Requirements:
  - .1 Provide English operator selectable access codes.
  - .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.
  - .3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.
  - .4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
  - .5 Include, in English:
    - .1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definitions).
    - .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English] at specified OWS and to be able to operate one terminal in English. Point name expansions in English.
    - .3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

## 1.6 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for review:
  - .1 Equipment list and systems manufacturers within 10 days after award of contract.
- .3 Quality Control:
  - .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements where applicable.
  - .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
  - .3 Submit proof of compliance to specified standards with shop drawings and product data. Label or listing of specified organization is acceptable evidence.
  - .4 In lieu of such evidence, submit certificate from testing organization, approved by [Engineer], certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
  - .5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
  - .6 Permits and fees: in accordance with general conditions of contract.
  - .7 Submit certificate of acceptance from authority having jurisdiction to Engineer.

## 1.7 QUALITY ASSURANCE

- .1 Have local office staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,

□

- .2 Provide record of successful previous installations showing experience with similar installations utilizing computer-based systems.
- .3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.
- .4 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.
- .5 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

## **1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Engineer with schedule within 2 weeks after award of Contract.
- .2 Waste Management and Disposal:
  - .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Engineer.
  - .1 Be responsible for items repaired or replaced by Engineer.
  - .2 Be responsible for repair costs due to negligence or abuse of equipment.

## **Part 2 Products**

### **2.1 EQUIPMENT**

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

### **2.2 ADAPTORS**

- .1 Provide adaptors between metric and imperial components.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S RECOMMENDATIONS**

- .1 Installation: to manufacturer's recommendations.

### **3.2 FIELD QUALITY CONTROL**

- .1 Verification requirements in accordance with Section 01 45 00 - Quality Control, including
- .2 :

- .1 Materials and resources.
- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local/regional materials.
- .7 Certified Wood.
- .8 Low-emitting materials.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Sequence of operation:
  - .1 Cabinet Heaters.
  - .2 Central refrigeration systems.
  - .3 Central fan systems.
  - .4 Electrical rooms and telephone rooms.
  - .5 Excess pressure controls.
  - .6 Heating Coils.
  - .7 Heating water zone control.
  - .8 Humidifiers.
  - .9 Terminal air units.
  - .10 Unit heaters.

**1.2 RELATED SECTIONS**

- .1 Section 25 05 01 – EMCS – General Requirements

**1.3 SYSTEM DESCRIPTION**

- .1 This section defines the manner and method by which controls function.
- .2 Requirements for each type of control system operation are specified.
- .3 Equipment, devices, and system components required for control systems are specified in other Sections.

**1.4 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00: Submission procedures.
- .2 Shop Drawings: Indicate mechanical system controlled and control system components.
  - .1 Label with settings, adjustable range of control and limits. Include written description of control sequence.
  - .2 Include flow diagrams for each control system, graphically depicting control logic.
  - .3 Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Submission procedures.
- .2 Record Documentation: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

**1.6 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 14000 or ISO 9000 certification requirements.



- .2 Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed at the place where the Project is located.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 CABINET HEATERS**

- .1 Fan Motor Thermostat: Single temperature electric thermostat mounted in cabinet return air set at 20 degrees C (68 degrees F) maintains constant space temperature by cycling unit fan motor.
- .2 Return Water Thermostat: Single temperature thermostat on return heating water line from floor mounted cabinet heaters to de-energizes unit on temperatures below 35 degrees C (95 degrees F).

**3.2 CENTRAL REFRIGERATION SYSTEMS**

- .1 Display: Display to show the following items.
  - .1 System graphic.
  - .2 Chilled water pump on/off switch.
  - .3 Chiller on/off indication.
  - .4 Chiller chilled water supply and return temperature.
  - .5 Common chilled water control point adjustment.
  - .6 Chilled water control point adjustment.
  - .7 Condensing water pump on/off [auto] switch.
  - .8 Chilled water pump on/off/auto switch.
  - .9 Chiller on/off/auto switch.

**3.3 CENTRAL FAN SYSTEMS**

- .1 Central Fan: Time schedule to start and stop supply and return fans. Determine fan status by current sensing devices. If fan fails to start as commanded, signal alarm.
- .2 Safety Devices:
  - .1 Freeze Protection: Stop fans and close outside air dampers if temperature downstream of preheat coil is below 3 degrees C (37 degrees F); signal alarm.
  - .2 High Temperature Protection: Stop fans and close outside dampers if temperature in return air is above 150 degrees C (300 degrees F); signal alarm.
  - .3 Smoke Detector: Stop fans, close outside dampers, and close smoke dampers if smoke is detected; signal alarm. Initiate Smoke Control Sequence of Operations.
- .3 Outside Air Damper: When supply fan is running, open outside air damper to minimum position. Prevent supply fan starting until outside air damper is open.
- .4 Humidifier: When supply fan is running, allow humidifier to operate as required.

- .5 Outside, Return, and Relief Dampers:
  - .1 When supply fan is not running, outside and relief dampers are closed and return damper is open.
  - .2 When supply fan is running, dampers are controlled and operate with outside and relief dampers opening, and return damper closing.
  - .3 For cooling and outside air temperatures below 12 degrees C (55 degrees), modulate dampers to maintain supply air temperature of 21 degrees C (70 degrees F).
  - .4 For cooling and outside air temperatures above 12 degrees C (55 degrees F), outside and relief dampers are open and return damper is closed.
  - .5 For cooling and outside air temperatures above 12 degrees C (55 degrees F), compare return and outside air temperatures. If return air temperature is lower, drive outside damper to minimum, close relief damper, and open return damper.
  - .6 For outside air temperatures above 26 degrees C (79 degrees F), drive outside damper to minimum, close relief damper, and open return damper.
  - .7 For heating, drive outside damper to minimum, close relief damper, and open return damper.
  - .8 Modulate mixed air dampers, preheat coil valve, cooling coil valve in sequence to maintain supply air temperature.
- .6 Display: Display to show the following items.
  - .1 System graphic.
  - .2 System on/off indication.
  - .3 System day/night mode.
  - .4 System fan on/off indication.
  - .5 Return fan on/off indication.
  - .6 Preheat coil pump on/off indication.
  - .7 Spray pump on/off indication.
  - .8 Outside air temperature indication.
  - .9 Mixed air temperature indication.
  - .10 Fan discharge air temperature indication.
  - .11 Reheat zone air temperature indication.
  - .12 Return humidity indication.
  - .13 Fan discharge temperature control point adjustment.
  - .14 Return humidity control point adjustment.
  - .15 Reheat zone control point adjustment.
  - .16 Supply static pressure indication.
  - .17 Supply static pressure control point adjustment.
  - .18 Building static pressure indication.
  - .19 Building static pressure control point adjustment.
  - .20 System on/off auto switch.
  - .21 System day/night/auto switch.
  - .22 Supply fan on/off switch.
  - .23 Return fan on/off/auto switch.
  - .24 Preheat coil pump on/off switch.
  - .25 Spray pump on/off auto switch.

### 3.4 ELECTRICAL ROOMS

- .1 Transfer Fans: On room temperatures above 35 degrees C (95 degrees F), start transfer fan.

### 3.5 HEATING COILS

- .1 Heating Valve Thermostat: Single temperature thermostat set at 21 degrees C (70 degrees F) maintains constant space temperature during the day and 8 degrees C (15 degrees F) cooler at night, by opening and closing, two-way control heating valve.

### 3.6 HEATING WATER ZONE CONTROL

- .1 Control Valves: Control heating water supply temperature set to outdoor reset schedule modulating heating water control valve] [to outdoor reset schedule] [modular boiler gas valve] [step firing boilers] [modulating steam control valve] [<90 degrees C><<195 degrees F>>].
  - .1 Outdoor Temperature Control: Control heating water at maximum 140 degrees F.
  - .2 Step Fire Sequence: Step fire boilers in sequence Include valve option where heat exchanger control is specified.
- .2 Pressure Switch: Pressure switch in heating water circuit on no flow conditions indicates alarm and closes valve.
- .3 Display: Display to show the following items.
  - .1 System graphic.
  - .2 System supply temperature.
  - .3 System supply control point adjustment.
  - .4 System return temperature.
  - .5 Pump on/off indication.
  - .6 Pump on/off switch.
  - .7 Boiler lead lag switch.

### 3.7 RADIATION [AND CONVECTORS]

- .1 Heating Valve Thermostat: Single temperature thermostat set at 21 degrees C (70 degrees F) maintains constant space temperature during the day and 8 degrees C (15 degrees F) cooler at night by opening and closing two-way control heating valve.

### 3.8 TERMINAL AIR UNITS

- .1 Heating Valve Thermostat: Single temperature thermostat set at 21 degrees C (70 degrees F) maintains constant space temperature during the day and 8 degrees C (15 degrees F) cooler at night by opening and closing two-way control heating valve. Edit to suit project conditions. Use the following for variable air volume (VAV) and dual duct systems.
- .2 Damper Control Thermostat: Single temperature thermostat set at 24 degrees C (75 degrees F) maintains constant space temperature by modulating variable volume damper operator.
- .3 Damper Operator: Where reheat coils or radiation is also provided, sequence two-way heating control valve with damper operator.

**3.9 UNIT HEATERS**

- .1 Electric Thermostat: Single temperature electric room thermostat maintains constant space temperature of 21 degrees C (68 degrees F) by cycling unit fan motor.
- .2 Return Air Thermostat: Single temperature thermostat on return heating water line from floor mounted cabinet heaters de-energizes unit on temperatures below 35 degrees C (95 degrees F).

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

.1 Section Includes:

- .1 General requirements that are common to NMS sections found in Division 26 – Electrical. This section supplements requirements of Division 1.

**1.2 REFERENCES**

.1 Canadian Standards Association (CSA International)

- .1 CSA C22.1-latest edition, Canadian Electrical Code
- .2 CSA C22.2
- .3 CAN/CSA-C22.3 No. 1-01, Overhead Systems.
- .4 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

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

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

- .1 Material Safety Data Sheets (MSDS).

**1.3 DESIGN REQUIREMENTS**

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English and French.

.4 Use one nameplate or label for each language.

**1.4 SUBMITTALS**

.1 Shop drawings:

- .1 Submittals: in accordance with Section 00 01 10 – General Instructions.
- .2 Submit drawings for review, prior to ordering/purchasing any equipment.

.2 Quality Control:

- .1 Provide CSA certified equipment and material.
- .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
- .3 Submit test results of installed electrical systems and instrumentation.
- .4 Permits and fees: in accordance with General Conditions of contract.
- .5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.

- .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Engineer.
- .3 Manufacturer's Field Reports: submit to Engineer, manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in QUALITY ASSURANCE.
- .4 Provide operation and maintenance data for incorporation into manual specified in Section 01 00 10 – General Instructions.

## 1.5 QUALITY ASSURANCE

- .1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 00 01 10 – General Instructions.

## 1.6 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 00 10 – General Instructions.

## 1.7 SYSTEM STARTUP

- .1 Instruct, Departmental Representative, Engineer and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

## Part 2 Products

### 2.1 MATERIALS AND EQUIPMENT

- .1 Material and equipment to be CSA certified. Where CSA certified equipment is not available, obtain special approval from authority having jurisdiction.
- .2 Factory assemble control panels and component assemblies.

### 2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Divisions 21 and 23 and as shown on mechanical drawings.

## 2.3 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Engineer.
- .2 Decal signs, minimum size 175 x 250 mm.

## 2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

## 2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.
  - .2 Sizes as follows:

### NAMEPLATE SIZES

|        |             |         |                    |
|--------|-------------|---------|--------------------|
| Size 1 | 10 x 50 mm  | 1 line  | 3 mm high letters  |
| Size 2 | 12 x 70 mm  | 1 line  | 5 mm high letters  |
| Size 3 | 12 x 70 mm  | 2 lines | 3 mm high letters  |
| Size 4 | 20 x 90 mm  | 1 line  | 8 mm high letters  |
| Size 5 | 20 x 90 mm  | 2 lines | 5 mm high letters  |
| Size 6 | 25 x 100 mm | 1 line  | 12 mm high letters |
| Size 7 | 25 x 100 mm | 2 lines | 6 mm high letters  |

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Engineer prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

## 2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.10-07.
- .4 Use colour coded wires in communication cables, matched throughout system.

## 2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

|                             | Prime  | Auxiliary |
|-----------------------------|--------|-----------|
| up to 250 V                 | Yellow |           |
| up to 600 V                 | Yellow | Green     |
| up to 5 kV                  | Yellow | Blue      |
| up to 15 kV                 | Yellow | Red       |
| Telephone                   | Green  |           |
| Other Communication Systems | Green  | Blue      |
| Fire Alarm                  | Red    |           |
| Emergency Voice             | Red    | Blue      |
| Other Security Systems      | Red    | Yellow    |

## 2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

## Part 3 Execution

### 3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

### 3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

### 3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

### 3.4 LOCATION OF OUTLETS

.1 Locate outlets as shown on drawings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.



- .4 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

### 3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

### 3.6 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### 3.7 FIELD QUALITY CONTROL

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct and pay for the following tests:
  - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .5 Systems: fire alarm system, communications.
  - .6 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
    - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Engineer.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:

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

**3.8 CLEANING**

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

**3.9 COORDINATION OF MECHANICAL AND ELECTRICAL WORK**

- .1 Provide complete wiring and connections for all motors and other electrical equipment specified in Division 23 and 25.
- .2 Determine characteristics of equipment specified in Division 23 and 25. Provide proper starters, relays, coils, auxiliary contacts and interlocks.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .2 CSA C22.2No.65-93(R1999), Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

**Part 2 Products**

**2.1 MATERIALS**

- .1 Pressure type wire connectors with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for armoured cable, flexible conduit as required.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
  - .2 Install fixture type connectors and tighten. Replace insulating cap.

**END OF SECTION**

**Part 1 General**

**1.1 GENERAL**

- .1 In general, the wiring is not shown on the drawings for the different systems: the necessary wiring shall however be provided between all outlets and the panels and/or relays to which they are referred to on drawings. In some cases, the panel identification is not given for each circuit but is shown for particular area.

**Part 2 Products**

**2.1 BUILDING WIRES**

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

**2.2 TECK CABLE**

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
  - .1 Grounding conductor: copper.
  - .2 Circuit conductors: copper, size as indicated.
- .3 Connectors:
  - .1 Watertight, approved for TECK cable.

**2.3 ARMoured CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90 - lead sheath over cable assembly and under armour.
- .3 Armour: interlocking type fabricated from aluminum strip.

**Part 3 Execution**

**3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34.
  - .2 All cables in suspended ceiling shall be properly strapped.
  - .3 Use armoured cables only in suspended ceilings when making final connection to equipment or in location(s) pre-approved by Engineer.

**3.2 INSTALLATION OF TECK CABLE 0 -1000 V**

- .1 Install cables.
  - .1 Group cables wherever possible on channels.

- .2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

**3.3           INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
  - .1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA International)

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 System and circuit, equipment, grounding conductors, bare, stranded copper, soft annealed, size as required.
- .3 Insulated grounding conductors: to section 26 05 21.
- .4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Thermit welded type conductor connectors.
  - .5 Bonding jumpers, straps.
  - .6 Pressure wire connectors.

**Part 3 Execution**

**3.1 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

- .7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

### 3.2 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

### 3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Electrical General Requirements.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**END OF SECTION**

**Part 1 Products**

**1.1 SUPPORT CHANNELS**

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended as required.

**Part 2 Execution**

**2.1 INSTALLATION**

- .1 Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole malleable iron or steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.



- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

**END OF SECTION**

**Part 1 General**

**1.1 SPLITTERS**

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

**1.2 JUNCTION AND PULL BOXES**

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

**Part 2 Execution**

**2.1 SPLITTER INSTALLATION**

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

**2.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

**2.3 IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Electrical General Requirements.
- .2 Install size 2 identification labels indicating voltage and phase.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1        CSA C22.1-2006, Canadian Electrical Code, Part 1.

**Part 2            Products**

**2.1            OUTLET AND CONDUIT BOXES GENERAL**

- .1        Size boxes in accordance with CSA C22.2.
- .2        102 mm square or larger outlet boxes as required for special devices.
- .3        Gang boxes where wiring devices are grouped.
- .4        Blank cover plates for boxes without wiring devices.
- .5        347 V outlet boxes for 347 V switching devices.
- .6        Combination boxes with barriers where outlets for more than one system are grouped.

**2.2            SHEET STEEL OUTLET BOXES**

- .1        Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2        Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3        102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4        102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

**.5            FITTINGS - GENERAL**

- .1        Bushing and connectors with nylon insulated throats.
- .2        Knock-out fillers to prevent entry of debris.
- .3        Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4        Double locknuts and insulated bushings on sheet metal boxes.

**2.3 CONDUIT BOXES**

- .1 Cast, malleable iron boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.
- .2 FITTINGS - GENERAL
  - .1 Threaded.
  - .2 Provide threaded plug fillers to prevent entry of debris.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

**END OF SECTION**

**Part 1 General**

**1.1 LOCATION OF CONDUITS**

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

**Part 2 Products**

**2.1 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel, threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 5 m oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

**2.3 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90 degree bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

**2.4 EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

**2.5 FISH CORD**

- .1 Polypropylene.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2        Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3        Use rigid galvanized steel threaded conduit except where conduit is subject to mechanical injury.
- .4        Use electrical metallic tubing (EMT) for general use, except in cast concrete.
- .5        Use rigid pvc conduit underground.
- .6        Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
- .7        Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8        Install conduit sealing fittings in hazardous areas. Fill with compound.
- .9        Minimum conduit size for lighting and power circuits: 19 mm.
- .10       Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .11       Mechanically bend steel conduit over 19 mm dia.
- .12       Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .13       Install fish cord in empty conduits.
- .14       Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .15       Dry conduits out before installing wire.
- .16       Bx will not be accepted.

**3.2                SURFACE CONDUITS**

- .1        Run parallel or perpendicular to building lines.
- .2        Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3        Run conduits in flanged portion of structural steel.
- .4        Group conduits wherever possible on suspended or surface channels.
- .5        Do not pass conduits through structural members except as indicated.

- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA C22.1 No.126.1-02, Metal Cable Tray Systems.
- .2 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA VE 1-2002, Metal Cable Tray Systems.
  - .2 NEMA VE 2-2001, Cable Tray Installation Guidelines.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**Part 2 Products**

**2.1 CABLETROUGH**

- .1 Non-Ventilated type
- .2 Trays: sheet aluminum 600 mm wide with depth of 100 mm.
- .3 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.
  - .1 Radii on fittings: 600 mm minimum.
- .4 Solid covers for complete cabletrough system including fittings.
- .5 Barriers where different voltage systems are in same cabletrough.
- .6 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.
- .7 Provide fire stop material at firewall penetrations.

**2.2 SUPPORTS**

- .1 Provide splices, supports [for a continuously grounded system] as required.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install complete cabletrough system in accordance with NEMA VE 2.
- .2 Support cabletrough on both sides.
- .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

**3.2 CABLES IN CABLETROUGH**

- .1 Install cables individually.



- .2 Lay cables into cabletrough. Use rollers when necessary to pull cables.
- .3 Secure cables in cabletrough at 6 m centres, with nylon ties.
- .4 Identify cables every 30m with size 2 nameplates in accordance with Section 26 05 00 – General Instructions.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 National Electrical Manufacture's Association (NEMA)

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**Part 2 Products**

**2.1 GENERAL**

- .1 Underfloor distribution materials: to NEMA.
- .2 Steel underfloor distribution system, buried type made up of runs of 2.0 mm thick minimum welded rectangular tubing with corrosion- resistant finish and matching junction boxes, couplings, supports accessories as required to make complete raceway installation. Components from same manufacturer and suitable for type of floor as indicated.

**2.2 DISTRIBUTION DUCTS**

- .1 Refer to electrical drawings. Underfloor duct details.

**2.3 FEEDER DUCTS**

- .1 Feeder ducts: minimum cross sectional area of [2130] [5030] mm<sup>2</sup> without inserts.

**2.4 INSERTS**

- .1 Internally threaded duct inserts with 50 mm IPS straight threads, with removable steel caps to seal open ends of inserts. Insert height to suit concrete topping over distribution ducts and not less than 25 mm.

**2.5 JUNCTION BOXES**

- .1 Junction boxes suitable for size and number of incoming and outgoing ducts, complete with means for adjusting junction box position to suit position of raceway prior to placing of concrete. Means for adjusting junction box to surface of finished floor after concrete is poured. Where multiple ducts are entering junction box, provide box partitions.

**2.6 SERVICE FITTINGS**

- .1 Service fittings: in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

**2.7 SUPPORTS**

- .1 Adjustable duct supports at [1.5] m centres in concrete slab.

**2.8 ACCESSORIES**

- .1 [Brass] [Stainless steel] [Nickel] marker screws for raceway inserts.

- .2 Holders on junction boxes for floor covering materials.
- .3 Plain junction box covers in stainless steel.
- .4 Connector assemblies consisting of adaptors and nipples for connection of service fittings to inserts.
- .5 Duct to conduit adapters, duct to cabinet or panel connectors, expansion joints, as required to make complete installation.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for floor raceway installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of General Contractor.
  - .2 Inform General Contractor of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from General Contractor.

#### **3.2 INSTALLATION**

- .1 Install underfloor distribution system complete with junction boxes, couplings, supports, adaptors and service fittings in accordance with manufacturer's recommendations.
- .2 Install with cover side down during construction period for protection of finish material.
- .3 Seal joints of underfloor distribution system with approved waterproof sealer and adjust separation barrier to bear firmly under lids prior to placing of concrete floors.
- .4 Install duct so that inserts are 3 mm below finished concrete floor.
- .5 Install marker screws on each end of every run, on either side of junction boxes, and on either side of permanent partitions.
- .6 Adjust marker screws flush so their heads show in cast-in-place surface of concrete.
- .7 Clean underfloor distribution system before installation of conductors and leave system free of moisture.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Electrical General Instructions.

**1.2 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
  - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
  - .4 LEED Canada-EB: O M-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.
- .2 CSA International
  - .1 CAN/CSA-Z809-08, Sustainable Forest Management.
- .3 Forest Stewardship Council (FSC)
  - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .4 Insulated Cable Engineers Association, Inc. (ICEA)
- .5 Sustainable Forestry Initiative (SFI)
  - .1 SFI-2010-2014 Standard.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**Part 2 Products**

**2.1 CABLE PROTECTION**

- .1 38 x 140 mm planks pressure treated with coloured, copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.
- .2 Duct banks are detailed on the drawings.

**2.2 MARKERS**

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.
- .2 Cedar post type markers: to CAN/CSA-Z809 or FSC or SFI 89 x 89 mm, 1.5 m long, pressure treated with coloured, copper naphthenate or 5% pentachlorophenol solution,

water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.

- .1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

#### **3.2 DIRECT BURIAL OF CABLES**

- .1 After sand bed in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable.
  - .1 Do not pull cable into trench.
- .2 Include offsets for thermal action and minor earth movements.
  - .1 Offset cables 150 mm minimum for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Make termination and splice only as indicated leaving 0.6 m minimum of surplus cable in each direction.
  - .1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.
- .4 Underground cable splices not acceptable.
- .5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written recommendations; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .6 Cable separation:
  - .1 Maintain 75 mm minimum separation between cables of different circuits.
  - .2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.
  - .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
  - .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

- .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
- .6 Install treated planks on lower cables 0.6 m minimum in each direction at crossings.
- .7 After sand protective cover specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, install continuous row of interlocking cable blocks, overlapping 38 x 140 pressure treated planks as indicated to cover length of run.

### 3.3 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

### 3.4 MARKERS

- .1 Mark cable every 150 m along duct runs and changes in direction.
- .2 Mark underground splices.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .4 Install concrete cable markers within 180 m from each side of runway centreline; 45 m from each side of taxi way centreline; 50 m from edge of taxi ramps or aprons.
- .5 Install cedar post type markers.
- .6 Lay concrete markers flat and centred over cable with top flush with finish grade.

### 3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using qualified personnel.
  - .1 Include necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds.
  - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests:
  - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

- .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests:
  - .1 Ensure that terminations and accessory equipment are disconnected.
  - .2 Ground shields, ground wires, metallic armour and conductors not under test.
  - .3 High Potential (Hipot) Testing.
    - .1 Conduct hipot testing at 95% of original factory test voltage in accordance with manufacturer's recommendations.
  - .4 Leakage Current Testing:
    - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
    - .2 Hold maximum voltage for specified time period by manufacturer.
    - .3 Record leakage current at each step.
- .7 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

### **3.6 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

### **3.7 PROTECTION**

- .1 Repair damage to adjacent materials caused by cables installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Electrical General Instructions.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI C39.1-1981, Requirements, Electrical Analog Indicating Instruments.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
  - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
  - .4 LEED Canada-EB: O M-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.
- .3 CSA International
  - .1 CAN3-C17-M84(R2008), Alternating - Current Electricity Metering.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**Part 2 Products**

**2.1 METER**

- .1 Polyphase, element, kilowatt-hour energy meter: to CAN3-C17.
- .2 Polyphase, element, kilowatt, kilovar, demand, thermally lagged, integrating,
- .3 recording meter: to CAN3-C17.
- .4 Combination energy and demand meter: to CAN3-C17.
- .5 Accuracy: 99.9%.
- .6 'S' socket, 'A', 'P' base, bottom connected, round, rectangular, flush switchboard draw out case, weatherproof.
- .7 Register: self contained, instrument transformer operated, clock, cyclometer, range, pulse contacts for transmitting signal.
- .8 Allow for remote sensing.



## 2.2 METER SOCKET

- .1 Weatherproof meter sockets to suit meters with automatic current transformer shorting devices when meter removed.

## 2.3 METER CABINET

- .1 Sheet steel CSA enclosure sprinkler proof with meter backplate, to accommodate meters, test terminal block and associated equipment, factory installed and wired.

## 2.4 METERING INSTRUMENT TRANSFORMER CABINET

- .1 Sheet steel CSA enclosure sprinkler proof to accommodate potential, current transformers.

## 2.5 TEST TERMINAL BLOCKS

- .1 Test terminal blocks: as required.

## 2.6 INDICATING INSTRUMENTS

- .1 Analogue indicating instruments: ANSI C39.1, 1% accuracy, switchboard mounting, projecting, flush, case size 112 mm round rectangular 90 degrees scale, suppressed scale, calibrated zero, operated from current transformer.
  - .1 Ammeter: average reading range as indicated.
  - .2 Voltmeter: average reading range as indicated.
  - .3 Wattmeter: range as indicated.
  - .4 Varmeter: range as indicated.
  - .5 Frequency meter: range as indicated.
  - .6 Power factor meter: range as indicated.
  - .7 Synchroscope: range as indicated.

## 2.7 INSTRUMENT SELECTOR SWITCHES

- .1 Voltmeter, Ammeter selector switches: rotary, multi-position, maintained contacts, panel mounting, round notched handle, rated to suit instrument's, nameplate marked as indicated to coincide with each rotary position. Ammeter selector switches designed to preclude opening of current circuits.
- .2 Four position ammeter selector switches identified "off-A-B-C".
- .3 Four position voltmeter selector switches identified "A-B, B-C, C-A, off".
- .4 Seven position voltmeter selector switches identified "A-B, B-C, C-A, off, A-N, B-N, C-N".

## 2.8 RECORDING INSTRUMENTS

- .1 Recording instruments: 1% accuracy switchboard mounting, direct acting marking device, continuous, intermittent marking, round strip chart size, spring, electric, driver timing mechanism, scale calibrated, end, centre, zero, operated from current transformer.
  - .1 Ammeter: range as indicated.
  - .2 Voltmeter: range as indicated.
  - .3 Wattmeter: range as indicated.
  - .4 Varmeter: range as indicated.

- .5 Frequency meter: range as indicated.
- .6 Power factor meter: range as indicated.

## **2.9 SHOP INSTALLATION**

- .1 Install meters and instrument transformers in separate compartment of switchboard.
- .2 Install instruments on panel switchboard.
- .3 Ensure adequate spacing between current transformers installed on each phase.
- .4 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metering and switchboard instruments installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant.

### **3.2 METERING INSTALLATION**

- .1 Install meters, instruments in location free from vibration and shock.
- .2 Make connections in accordance with diagrams.
- .3 If applicable, ensure power factor corrective equipment connected on load side of meter.
- .4 Connect meter and instrument transformer cabinets to ground.
- .5 Locate meters within 9 m of instrument transformers.
  - .1 Use 32 mm conduit for interconnections.
  - .2 Use separate conduit for each set of current transformer connections, exclusive for metering.

### **3.3 FIELD QUALITY CONTROL**

- .1 Conduct tests in accordance with Section 26 05 00 - Common Work Results for Electrical and in accordance with manufacturer's recommendations.
- .2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.
- .3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.
- .4 Perform tests to obtain correct calibration.
- .5 Do not dismantle meters and instruments.

**3.4 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

**3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metering and switchboard instrument installation.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Networked Central Lighting Control systems. Systems are composed of:
    - a. Network integrated power switching systems.
    - b. Network integrated dimming systems.
    - c. Automation control processors.
    - d. Sensors
    - e. User Interfaces:
      - 1) Keypad
      - 2) Touch screen
      - 3) Virtual touch screen
  - 2. System Functions and Sequences

### **1.2 SYSTEM DESCRIPTION**

- A. Web Accessible, network connected, lighting control system utilizing preset control software, central signal microprocessor, lighting control panel including integrated branch circuit protection, and power switching modules and relays, Dimming Modules Sensors, User Interfaces.
- B. System Components: System includes the following addressable components:
  - 1. Automation control processor
  - 2. Keypad controls.
  - 3. Touch screen controls.
  - 4. Window treatment controls.
  - 5. Remote occupancy sensors.
  - 6. Lighting load shedding.
  - 7. Timed room lighting.
  - 8. Daylight compensating lighting controls.
  - 9. Communication interface to facility-wide room management system.
  - 10. Communication interface to building automation system gateway/interface.
- C. Unified System Integration – Automation control processor supports native communication protocol utilized by the AV control system.
  - 1. Communication protocol adaptors or translation interfaces between AV control system and lighting control system will not be accepted.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product required for complete network lighting control system, demonstrating compliance with requirements.
- B. Shop Drawings: Indicated the following:
  - 1. Schematic diagram showing complete network lighting control system and accessories.
  - 2. Circuits and emergency circuits with capacity and phase, control zones, load type and voltage per circuit.
  - 3. Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

### INFORMATIONAL SUBMITTALS

- C. CEC CCR Title 24 appliance efficiency listing certification.
- D. Sample of manufacturer's warranty.
- E. Load Measurement Report: Submit field test report of completed installation.

### 1.4 CLOSEOUT SUBMITTALS

- A. Operating and maintenance instructions.

### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualification: Manufacturer of network lighting controls with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.
- B. Source Requirements: Provide Network Lighting System through a single source from a single manufacturer.
- C. Manufacturer Qualifications: Approved manufacturer of network lighting controls listed in this Section with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.
  - 1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
    - a. Product data, including certified independent test data indicating compliance with requirements.
    - b. Samples of each component.
    - c. Sample submittal from similar project.
    - d. Project references: Minimum of 5 installations not less than 5 years old, with Owner and Architect contact information.
    - e. Sample warranty.
  - 2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.

3. Approved manufacturers must comply with separate requirements of Submittals Article.
- D. Electrical Components, Devices, and Accessories: UL listed and labeled per NFPA 70.
- E. California Appliance Efficiency Listing: Provide products that comply with provisions of CEC CCR Title 24, Part 6.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of modular dimming controls system the fail in materials or workmanship within the specified warranty period following substantial completion.
  1. Warranty Period: Touch screen display and overlay components: 90 days.
  2. Warranty Period: Disc drives and other moving parts, pan/tilt heads, and power supplies: 1 year.
  3. Warranty Period: Other components, 3 years.
- B. Manufacturer's Extended Support Service: Extended telephone support: Unlimited period.

## PART 2 PRODUCTS

### 2.1 SWITCHING SYSTEM

- A. MANUFACTURERS
  1. Basis-of-Design: **Crestron Electronics, Inc.**
- B. SYSTEM CHARACTERISTICS
  1. Web-accessible, network-connected programmable lighting control system that receives digital or analog signals from addressable input devices, assembles signals at central signal processor, and distributes operating signals to addressable control devices that effect a change in state.
    - a. Electronic power switching modules and relays process signals and effect circuit on-off switching, emergency switching, and 0 – 10V fluorescent dimming where indicated. Emergency switching overrides preset state and puts each circuit to the programmed emergency condition. Buttons on the module provide manual disconnect and manual circuit testing.
- C. NETWORK LIGHTING CONTROL PANELS
  1. Control Panels, General: Comply with NEMA PB 1 and UL 50 (CAN/CSA C22.2, No. 94), UL 67 (CSA C22.2, No. 29), UL 489 (CAN/CSA C22.2, No. 65), and UL 916 (CSA C22.2, No. 205).
  2. Network Lighting Control Panel
- D. POWER SWITCHING MODULES
  1. Switching Module, High Inrush:

- a. Basis of Design Product: Crestron Electronic Power Switching Module Model No. GLXP-SW-\_\_.
  - b. Channels of Switching: 16 channel high inrush switching.
  - c. Maximum Load.
    - 1) Lighting: 16A per channel.
    - 2) Motor: 1HP at 120V per channel.
2. Switching Module, 0 – 10V Dimmable LED:
  - a. Basis of Design Product: Crestron Electronic power switching module Model No. GLXP-DIMFLV8.
  - b. Channels of Switching: 8 channel high inrush switching.
  - c. Maximum Non-dimmable Load:
    - 1) Incandescent, HID, magnetic low voltage (MLV), electronic low voltage (ELV), neon/cold cathode, and fluorescent ballasts: 16A per channel.
    - 2) Motor: 1/2HP at 120V per channel.
  - d. Maximum Dimmable Load:
    - 1) Lighting: 0 - 10V dimmable fluorescent ballasts.
3. Switching Module, Heavy Duty:
  - a. Basis of Design Product: Crestron Electronic Power Switching Module Model GLXX-HDSW\_\_.
  - b. Channels of Switching: 16 channel high inrush switching.
  - c. Maximum Load.
    - 1) Lighting: 20A per channel.
    - 2) Up to 480V
    - 3) Motor: 1.5HP at 120v per channel.
  - d. Power Switching Relay, Single Pole.
    - 1) Basis of Design Product: Crestron Model No. GLR-HD-1P.
  - e. Power Switching Relay, Double Pole.
    - 1) Basis of Design Product: Crestron Model No. GLR-HD-2P.

## 2.2 ACCESSORIES

### A. PANEL ACCESSORIES

1. Emergency Phase Loss Sensor: 120/277V, tripping transfer to emergency state.
  - a. Basis of Design Product: Crestron Model No. GLS-PLS-120/277.
2. Power Supply: 50W, 24 V regulated power supply with two 4-pin network connectors, fuse-protected.
  - a. Basis of Design: Crestron Cresnet Power Supply Model GLA-PWS-50.

## 2.3 AUTOMATION CONTROL PROCESSORS

### A. Manufacturers

1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of **Crestron Electronics, Inc., Rockleigh, NJ 07647**, Phone (800)237-2041, Fax: (201)767-1903, [www.crestron.com](http://www.crestron.com) or comparable products from a single manufacturer approved by Architect prior to bidding, with the following components and characteristics.

## 2.4 CONTROL PROCESSOR

### A. Control Processor: DIN-rail mounted programmable control processor for lighting and automation applications.

1. Basis of Design Product: Crestron, DIN-AP3 Automation Controller.

### B. Minimum Characteristics:

#### 1. Operating System:

- a. Modular architecture supports multiple simultaneous running programs.
  - 1) Number of simultaneously running user programs: 10
- b. Real-time, preemptive multithreaded/multitasking kernel.
- c. Vector floating point coprocessor.
- d. Utilize a real time, event driven, multi-tasking, multi-threaded operating system.

#### 2. Communication:

- a. Control Processor shall support direct communication with the following devices:
  - 1) Connected Ethernet devices.
  - 2) Devices connected to built-in control ports.
  - 3) Proprietary control network devices.
  - 4) BACnet IP devices.
  - 5) Control processors of same type.

#### 3. Native BACnet/IP

- a. Number of BACnet objects supported: 500

#### 4. File Structure:

- a. Transaction-safe extended FAT32 file system

#### 5. Memory:

- a. RAM:
  - 1) 256 MB
- b. Flash:



- 1) Built-In: 2 GB
    - 2) MMC slot: up to 2 GB
  6. Network:
    - a. Built-in 10/100BaseT Ethernet port.
    - b. Built-In Web Server: IIS v.6.0
    - c. SNMP remote management.
    - d. Active Directory support.
    - e. IPv6 ready.
    - f. TCP/IP Communications
    - g. DHCP and DNS Support
    - h. Native Email Client
    - i. Remote Diagnostics
    - j. Remote Program Loading and Administration
    - k. SSL security plug in
    - l. Support user assigned or dynamic IP address.
- C. External Ports  
The control system shall be equipped with the following external connection ports:
  1. Connections:
    - a. I/O 1 – 8: One 9-pin terminal block with 8 digital input/output or analog input ports.
    - b. Relays: One 8-pin terminal block with four normally open isolated relays.
    - c. Computer: One USB female 1.1 computer console port.
    - d. LAN: One 8-wire RJ-45 connector.
    - e. NET: Two 4-pin terminal blocks paralleled.
    - f. Com 1 – 2: Two 5-pin terminal blocks.
    - g. IR/Serial 1 – 4: One 8-pin terminal block with four IR/Serial output ports.
- D. BACnet Protocol Implementation:
  1. BACnet Standardized Device Profile:
    - a. Application Specific Controller (B-ASC)
  2. BACnet Interoperability Building Blocks Supported:
    - a. Data Sharing - ReadProperty-A (DS-RP-A)
    - b. Data Sharing - ReadProperty-B (DS-RP-B)
    - c. Data Sharing - ReadProperty Multiple - A (DS-RPM-A)
    - d. Data Sharing - ReadProperty Multiple - B (DS-RPM-B)
    - e. Data Sharing - WriteProperty-A (DS-WP-A)
    - f. Data Sharing - WriteProperty-B (DS-WP-B)

- g. Data Sharing – COV – A (DS-COV-A)
    - h. Data Sharing – COV – B (DS-COV-B)
    - i. Device Management-Dynamic Device Binding-A (DM-DDB-A)
    - j. Device Management-Dynamic Device Binding-B (DM-DDB-B)
    - k. Device Management-Dynamic Object Binding-B (DM-DOB-B)
    - l. Device Management-DeviceCommunicationControl-B (DM-DCC-B)
  - 3. Standard Object Types Supported:
    - a. Device Object
    - b. Analog Input Object
    - c. Analog Value Object
    - d. Binary Input Object
    - e. Binary Value Object
    - f. Multi-State Input
    - g. Multi-State Value
  - 4. Data Link Layer Options:
    - a. BACnet IP
    - b. BACnet IP, Foreign Device
  - 5. Network Options:
    - a. BACnet/IP Broadcast Management Device (BBMD)
      - 1) Supports registration by foreign devices.
  - 6. Character Set Supported:
    - a. ANSI X3.4
  - 7. System Clock: Firmware-based internal clock.
- E. Power Requirements:
- 1. Power Supply: External.
    - a. Power Requirement: 8 Watts (0.33 amps at 24VDC).

## 2.5 USER INTERFACES

- A. Touch Screen Type 1: Controls lighting and AV settings along with other modular dimming controller functions.
  - 1. 7 inch TFT active-matrix color LCD touch screen 800 by 480 WVGA resolution display.
    - a. Basis of design: Crestron TSW-750 Touch Screen.
  - 2. 18-bit 262k colors, and dual-window HD video, HDTV, and high-resolution RGB streaming multimedia, IP intercom, and web browsing capabilities. Dynamic graphics and text capability. Enables custom control screen programming.
  - 3. Hard keys: 5 pushbuttons.

4. Communication:
  - a. Bidirectional 10/100 Mbps Ethernet communication.
5. Streaming Video:
  - a. H.264
  - b. MJPEG
6. Audio
  - a. Built-in microphone and speaker.
  - b. Intercom:
    - 1) Compatible with SIP capable devices from same manufacturer.
7. Power:
  - a. IEEE 802.3af Class 3 PoE Powered Device
8. Mounting:
  - a. Surface mount over 2-gang or 3-gang electrical box.
9. Color: White.

B.

KEYPAD:

1. Remote Keypad Controls: Field-configurable remote keypad with auto-adjusting backlight illuminating replaceable, engravable programmable buttons in number indicated, with white LED indicators, configured to fit in standard single-gang box.
  - a. Basis of Design: Crestron, Cameo Series Keypad Model C2N-CBD-P Series.
  - b. Color: As selected from manufacturer's full range of minimum 12 colors.
  - c. Faceplates: client to confirm button style.

## 2.6 SENSORS

- A. Remote Occupancy Sensor: Detects movement within space while reducing false triggering or shutoffs while space is occupied. Combination of ultrasonic motion detection and passive infrared detection with internal microprocessor. Sensor independently adjustable for installed conditions. Delayed time off adjustment. Walk-through mode. Adjustable built-in photocell for daylight optimization. Equipped with 4-wire interface for direct connection to control bus;
  1. Basis of Design: **Crestron Dual Technology Occupancy Sensor Model GLS-ODT-C-CN**
  2. Photocell: Built-in ambient light photocell
  3. Additional Interfacing: includes connection port for additional photocell.
  4. Coverage: 360 deg., 2000 sq. ft.
  5. Set-up and commissioning: parameters shall be configurable via a handheld wireless remote.
  6. Mounting: 3" octagon box

- B. Outdoor Photo Sensor:
  - 1. Sensor shall continually monitors the total ambient light level and can adjust the lighting as necessary to reach the desired light level. The sensitivity is adjustable so that a 10V signal matches full daylight and 0V matches total darkness. A built in visor provides more consistent readings by blocking direct sunlight, and also protects the lens from the elements.
  - 2. Basis of Design: **Crestron Photocell Model GLS-LEXT**
  - 3. Light Sensitivity 5 to 750 foot-candles
  - 4. Power: 24 VDC
  - 5. Mounting: surface mount
- C. Sensor Interface Device: Integrates occupancy sensors and related sensors with control network. In separate enclosure. 4-wire bus providing 24 VDC power to network devices, with two independent sensing inputs.
  - 1. Basis of Design: **Crestron Sensor Integration Module Model GLS-SIM.**

## 2.7 CONDUCTORS AND CABLING

- A. Power Supply Side of Remote-Control Power Sources: Comply with requirements of Division 26 Section "Low-Voltage Electrical Power Conductors."
- B. UTP Cable: 100-ohm, UTP. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
  - 1. Communications Control Cable, Non-Plenum Rated: 22 AWG data pair stranded bare copper, and 18 AWG power pair stranded bare copper, Type CM.
    - a. Basis of Design Product: **Crestron CRESNET-NP.**
  - 2. Communications Control Cable, Plenum Rated: 22 AWG data pair, stranded bare copper and 18 AWG power pair, stranded bare copper, Type CMP, complying with NFPA 262.
    - a. Basis of Design Product: **Crestron CRESNET-P.**
  - 3. Communications High-Power Control Cable, Non-Plenum Rated: 22 AWG stranded bare copper data pair, and 12 AWG stranded bare copper power pair, Type CM.
    - a. Basis of Design Product: **Crestron CRESNET-HP-NP.**

## 2.8 SYSTEM FUNCTIONS AND SEQUENCES

- A. System Control Functions: The system shall be capable of the following lighting control functions:
  - 1. Scene Creation: store levels of selected fixture circuits in preset groups.
  - 2. Scene Recall: recall previously stored scenes.
  - 3. Off: all zones off.
  - 4. Dim up/down: raise/lower level of all zones.

5. Password Entry: enter password to enable touch screen control access.
6. Room/Zone Selection: select room, zone or area to be controlled.
7. Shade Control: raise or lower room shades.
8. Event Scheduler: select times for scenes to be automatically recalled.

## **2.9 USER INTERFACE CONTROL FUNCTIONS**

- A. Remote Keypad: The Keypad interface shall be capable of the following system control functions:
  1. Scene Recall
  2. Off
  3. Dim up/down
- B. Touch Screen and Virtual Touch Screen: Touch Screen and Virtual Touch Screen interfaces shall be capable of the following system control functions:
  1. Password Entry
  2. Room/Zone Selection
  3. Scene Recall
  4. Dim up/down
  5. Shade Control
  6. Scene Recall
  7. Dynamic Scene Settings
  8. Event Scheduler
- C. Integrated System Control
  1. Integrated Audio-Visual system and Lighting system control: See Division 27.
  2. Automation and Management Systems: Section 25 13 13
  3. Control and Monitoring Systems: Section 25 15 16

## **2.10 PROGRAMMING AND CONFIGURATION SOFTWARE**

- A. Lighting system configuration software shall allow custom programming of embedded operating systems for control of lighting system.
- B. Lighting system configuration software shall Provide a graphical symbol based programming and development environment.
- C. Custom Software Control Interface Module – The Lighting System Configuration software shall generate Custom Software Control Interface Modules for communication with compatible remote integrated systems.
- D. The Custom Software Control Interface shall include the following control data:
  1. Complete lighting system control functions.
  2. System specific control sets for sub systems and supervisory systems.

- E. The Custom Software Control Interface shall be capable of communicating the following data types:
  - 1. Bidirectional digital and analog data communication.
  - 2. Bidirectional serial data communication.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Prior to installation, examine work area to verify measurements, and that commencing installation complies with manufacturer's requirements.

### **3.2 INSTALLATION**

- A. Comply with requirements of Division 26 Sections "Common Work Results for Electrical."
- B. Do not install network power controls until space is enclosed, HVAC systems are running, and overhead and wet work in space are complete.
- C. Install network power switching controls in accordance with manufacturer's instructions.
- D. Grounding: Provide electrical grounding in accordance with NFPA 70.
- E. Provide panelboard schedule in pocket provided in panel doors.

### **3.3 SYSTEM OPERATING SOFTWARE**

- A. Contractor shall furnish media which will contain:
  - 1. Software and current licenses.
  - 2. All source code pertaining to the System.
  - 3. All compiled programs pertaining to the System.
  - 4. All graphics files pertaining to the System.
  - 5. Custom Software Control Interface Module(s) for integration with:
    - a. AV Control Systems: Section 27 41 00
    - b. Automation and management systems: Section 25 13 13
    - c. Control and monitoring systems: Section 25 15 16

### **3.4 SYSTEM STARTUP**

- A. Provide manufacturer's system startup and adjustment.
- B. Switch each load on and off with manual line test feature of the power switching module before installing processors.
- C. Perform operational testing to verify compliance with Specifications. Adjust as required.

### **3.5 ADJUSTING**

- A. Within 12 months of the date of Substantial Completion provide onsite service to adjust the system to account for actual occupied conditions.

### **3.6 DEMONSTRATION**

- A. Factory authorized service representative to instruct owner's staff to adjust, operate and maintain network power switching systems; and provide instruction using the system software.

### **3.7 CLOSEOUT ACTIVITIES**

- A. Demonstration: Schedule demonstration with Owner.
- B. Training: Train Owner's personnel to operate, maintain, and program network power switching systems. Allow for a minimum of trips to the jobsite to provide additional training as needed.
  - 1. Furnish set of approved submittals, and record drawings of actual installation for Owner's personnel in attendance at training session.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Dry type transformers with ratings up to 5000 kVA single phase and up to 7500 kVA three phase and voltage class up to 46 kV.

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C9-M1981(R2001), Dry-Type Transformers.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1 EEMAC GL1-3-1988, Transformer and Reactor Bushings.
- .3 National Electrical Manufacturers Association (NEMA)

**1.3 SOURCE QUALITY CONTROL**

- .1 Submit test certificate to Consultant.

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings electronically in PDF format.
- .2 Include:
  - .1 Dimensioned drawing showing enclosure, mounting devices, terminals, taps, internal and external component layout.
  - .2 Technical data:
    - .1 kVA rating.
    - .2 Primary and secondary voltages.
    - .3 Frequency.
    - .4 Phase
    - .5 Polarity or angular displacement.
    - .6 Full load efficiency.
    - .7 Regulation at unity pf.
    - .8 BIL.
    - .9 Insulation type.
    - .10 Sound rating.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Store transformers indoors in dry location.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Dry-type transformers: to CSA C9.



## **2.2 TRANSFORMER CHARACTERISTICS**

- .1 Provide transformer sized as per drawings and SLD:
  - .1 Type: ANN
  - .2 Rating: kVA as indicated, 3 phase, 60 Hz.
  - .3 220 insulation system class, 150 degrees C temperature rise.
  - .4 Impedance: 4.5-5.5 %
  - .5 BIL 10kV
  - .6 Primary winding: 600V, delta
  - .7 Secondary winding: 480V, wye
  - .8 Sound rating: 50dB max.

## **2.3 ENCLOSURE**

- .1 Fabricated from sheet steel.
- .2 Bolted removable panels for access to tap connections, enclosed terminals
- .3 Designed for floor.
- .4 Ventilated, self cooled type, enclosure c/w drip shield.

## **2.4 VOLTAGE TAPS**

- .1 Standard.

## **2.5 WINDINGS**

- .1 Primary and secondary coils:
  - .1 Copper.

## **2.6 WARRANTY**

- .1 Guarantee that all materials are first-class and proper for their intended use. Further guarantee is required on all materials and workmanship for a period of one (1) year from start-up or a maximum of eighteen (18) months after delivery. Make any repairs at no extra cost during this warranty period so that all equipment operates properly.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1        Section 26 05 00 – Electrical General Instructions.

**1.2            REFERENCES**

- .1        Canada Green Building Council (CaGBC)
- .2        CSA Group
  - .1        CSA C22.2 No.31-10, Switchgear Assemblies.

**1.3            SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**Part 2           Products**

**2.1            SERVICE ENTRANCE BOARD**

- .1        Service Entrance Board: to CSA C22.2 No.31.
- .2        Rating:600 V, 3 phase,3 wire, 1200 A, short circuit current 35 kA (rms symmetrical).
- .3        Cubicles: free standing, dead front, size as indicated.
- .4        Barrier metering section from adjoining Sections.
- .5        Provision for installation of power supply authority metering in barriered Section.
- .6        Owners metering.
- .7        Distribution section.
- .8        Hinged access panels with captive knurled thumb screws.
- .9        Bus bars and main connections: 99.3% copper.
- .10      Bus from load terminals of main breaker via metering section to main lugs of distribution section.
- .11      Cable from load terminals of main breaker to metering section and bus from metering section to lugs of distribution section.
- .12      Identify phases with colour coding.

**2.2            MOULDED CASE CIRCUIT BREAKERS**

- .1        Refer to Single Line diagram.
- .2        To be draw-out type.
- .3        Adjustable trip

**2.3            GROUNDING**

- .1        Copper ground bus extending full width of cubicles and located at bottom.
- .2        Lugs at each end for size 4/0 grounding cable.

## **2.4 POWER SUPPLY AUTHORITY METERING**

- .1 Separate compartment and metal raceway for exclusive use of power supply authority metering.
- .2 Mounting accessories and wiring for metering supplied by power supply authority:
  - .1 2 potential transformers.
  - .2 2 current transformers.
  - .3 Watthour meter.
  - .4 Demand meter with kWh register.

## **2.5 FINISHES**

- .1 Apply finishes in accordance with Section 26 05 00 - Common Work Results for Electrical.
  - .1 Service entrance board exterior: gray.

## **2.6 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical].
- .2 Nameplates:
  - .1 White plate, black letters, size 7.
  - .2 Complete board labelled: "600 V."
  - .3 Main disconnect labelled: "Main Breaker".
  - .4 Branch breakers labelled: as indicated on single line diagram.

## **2.7 SOURCE QUALITY CONTROL**

- .1 Consultant sign off on final factory tests, prior to installation of switchboard on site.
- .2 Notify in writing 5 days in advance that service entrance board is ready for testing.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for service entrance board installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

### **3.2 INSTALLATION**

- .1 Locate service entrance board and bolt to floor in suitable location in main electrical room
- .2 Connect main secondary service to line terminals of main breaker.
- .3 Connect load terminals of distribution breakers to feeders.

- .4 Check factory made connections for mechanical security and electrical continuity.
- .5 Run one grounding conductor 4/0 AWG bare copper from ground bus to building ground.
- .6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.
- .7

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with manufacturers specifications.
- END OF SECTION

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Submit product data in accordance with Section 26 05 00 – Electrical General Instructions.

**1.2 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
  - .3 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.
  - .4 LEED Canada for Existing Buildings, Operations and Maintenance-2009, LEED Canada 2009 Leadership In Energy and Environmental Design Green Building Rating System Reference Guide.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**Part 2 Products**

**2.1 CIRCUIT BREAKERS**

- .1 Design 1: indoor SF-6 circuit breaker, 3 pole, single break, power operated, draw out
- .2 Breaker operating mechanism:
  - .1 120 V AC solenoid closing and 24 V DC shunt trip.
  - .2 Stored energy closing.
- .3 Breaker interrupting capacity: 35 kAIC.
- .4 Breaker tripping devices, solid state as indicated.
  - .1 2 instantaneous overcurrent relays.
  - .2 Reverse power relay.
  - .3 Overvoltage relay.
  - .4 Undervoltage relay.
  - .5 Frequency relay.
  - .6 Time overcurrent relay.
  - .7 Locking-out relay.
  - .8 Time-delay relay.
  - .9 Ground fault relay.

- .10 Negative sequence relay.
- .5 Trip setting devices: dials.
- .6 Auxiliary contacts: 2 - N.O., 2 - N.C.
- .7 Auxiliaries:
  - .1 Status light: open-green, close-red.
  - .2 Status flags: open-green, close-red.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for switchboard installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

#### **3.2 MANUFACTURER'S INSTRUCTIONS**

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

#### **3.3 INSTALLATION**

- .1 As indicated.

#### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Materials and installation for standard and custom breaker type panelboards.

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.

**1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 26 05 00 – Electrical General Requirements.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**Part 2 Products**

**2.1 PANELBOARDS**

- .1 Panelboards: to CSA C22.2No.29 and product of one manufacturer.
  - .1 Install circuit breakers in panelboards before shipment.
  - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .3 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .4 Two keys for each panelboard and key panelboards alike.
- .5 Copper bus with neutral of same ampere rating as mains.
- .6 Mains: suitable for bolt-on breakers.
- .7 Trim with concealed front bolts and hinges.
- .8 Trim and door finish: baked grey enamel

**2.2 BREAKERS**

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

**2.3 EQUIPMENT IDENTIFICATION**

- .1 Nameplate for each panelboard size 4 engraved.

- .2 Nameplate for each circuit in distribution panelboards size 2 engraved.
- .3 Complete circuit directory with typewritten legend showing location and load of each circuit.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Connect loads to circuits.

**END OF SECTION**



**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Wall switches.
- .2 Lighting control switches – as per electrical legend
- .3 Receptacles.
- .4 Device plates and decorative box covers.
- .5 Floor box service fittings.
- .6 Poke-through service fittings.
- .7 Access floor box.

**1.2 RELATED SECTIONS**

- .1 Section 26 05 34 - Boxes.

**1.3 REFERENCES**

- .1 CSA-C22.1-12 - Canadian Electrical Code, Part I (22nd Edition), Safety Standard for Electrical Installations.
- .2 CSA-C22.2 No. 42-10 - General Use Receptacles, Attachment Plugs, and Similar Wiring Devices.
- .3 CSA-C22.2 No. 42.1-13 - Cover Plates for Flush-Mounted Wiring Devices.
- .4 CSA-C22.2 No. 55-1986 (R2012) - Special Use Switches.
- .5 CSA-C22.2 No. 111-10 - General-Use Snap Switches.
- .6 CSA-C22.2 No. 184.1-96 (R2011) - Solid-State Dimming Controls.
- .7 CSA (Canadian Standards Association).
- .8 UL (Underwriters Laboratories Inc.).

**1.4 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

**1.5 REGULATORY REQUIREMENTS**

- .1 Provide products listed and classified by UL / CSA as suitable for the purpose specified and indicated.

**Part 2 Products**

**2.1 WALL SWITCHES**

- .1 Description: CSA-C22.2 No. 111, AC only general-use snap switch.
- .2 Body and Handle: Ivory plastic with rocker handle (decora type).

- .3 Ratings: Match branch circuit and load characteristics.

## 2.2 RECEPTACLES

- .1 Description: CSA-C22.2 No. 42 general use receptacle.
- .2 Device Body: Ivory plastic.
- .3 Configuration: Type as specified and indicated.
- .4 Convenience Receptacle: Type 5-15.
- .5 GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

## 2.3 WALL PLATES

- .1 Decorative Cover Plate: Smooth stainless steel.

## Part 3 Execution

### 3.1 EXAMINATION

- .1 Verify that outlet boxes are installed at proper height.
- .2 Verify that wall openings are neatly cut and will be completely covered by wall plates.
- .3 Verify that floor boxes are adjusted properly.
- .4 Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- .5 Verify that openings in access floor are in proper locations.

### 3.2 PREPARATION

- .1 Provide extension rings to bring outlet boxes flush with finished surface.
- .2 Clean debris from outlet boxes.

### 3.3 INSTALLATION

- .1 Install to CSA-C22.1.
- .2 Install devices plumb and level.
- .3 Install switches with OFF position down.
- .4 Install receptacles in orientation specified by manufacturer.
- .5 Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- .6 Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- .7 Connect wiring devices by wrapping conductor around screw terminal.
- .8 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- .9 Install protective rings / split nozzle on active flush cover service fittings.

### 3.4 INTERFACE WITH OTHER PRODUCTS

- .1 Coordinate locations of outlet boxes with architectural drawings. If discrepancy, follow architectural drawings.
- .2 Install wall switch 1.2 m (48 inches) above finished floor.
- .3 Install convenience receptacle 450 mm (18 inches) above finished floor.
- .4 Install convenience above counter at 150 mm (6 inches).
- .5 Install dimmer 1.2 m (48 inches) above finished floor.
- .6 Install telephone jack 450 mm (18 inches) above finished floor.
- .7 Install telephone jack for side-reach wall telephone to position top of telephone at 1.4 m (54 inches) above finished floor.
- .8 Install telephone jack for forward-reach wall telephone to position top of telephone at 1.2 m (48 inches) above finished floor.

### 3.5 FIELD QUALITY CONTROL

- .1 Inspect each wiring device for defects.
- .2 Operate each wall switch with circuit energized and verify proper operation.
- .3 Verify that each receptacle device is energized.
- .4 Test each receptacle device for proper polarity.
- .5 Test each GFCI receptacle device for proper operation.

### 3.6 ADJUSTING

- .1 Adjust devices and wall plates to be flush and level.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Submit product data in accordance with Section 26 05 00 – Electrical General Instructions.

**1.2 PAYMENT**

- .1 Payment for field testing of ground fault equipment performed by Contractor and equipment manufacturer.

**1.3 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Design and Construction.
  - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
  - .4 LEED Canada-EBOM 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Existing Buildings: Operations and Maintenance.
- .2 CSA International
  - .1 CAN/CSA C22.2 No. 144-06(R2011), Ground Fault Circuit Interrupters.
- .3 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA PG 2.2-1999(R2009), Application Guide for Ground Fault Protection Devices for Equipment.

**1.4 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Ground fault protective equipment: components of one manufacturer.
- .2 Provide ground fault protection on 1200A, 600V, 3 wire, 3 phase service: to NEMA PG 2.2, CAN/CSA C22.2 No. 144.
- .3 Ground fault unit to contain:
  - .1 Ground sensing relay suitable for operation and factory set suitable 30 mA - 9 A trip current range. Control voltage: 120 V.
  - .2 Ammeter with scale 0 to 1.0 A to indicate ground current value.

- .3 Three position sensitivity control switch to select value of leakage current at which relay will operate.
- .4 Indicating lamp illuminated when no ground fault exists, extinguished on ground fault or test.
- .5 Switch:
  - .1 SPDT contacts for alarm [and trip].
  - .2 Mechanical target indication.
  - .3 Manual reset.
- .6 Reset button for contacts and target.
- .7 Suitable for panel mounting, coordinate with selected switchboard manufacture.
- .4 Zero sequence current transformer toroidal type with 300 - 3000 mA range.
- .5 Neutral:
  - .1 Use an artificial neutral and grounding resistor.
  - .2 Use neutral ground resistor unit.
- .6 System to operate on time delay, 20ms and 6s at ground current setting.

## 2.2 FABRICATION

- .1 Install following components in equipment specified in other Sections and as indicated.
  - .1 Zero sequence transformer.
  - .2 Ground fault relay.
  - .3 Ground resistor unit.

## 2.3 RELATED EQUIPMENT

- .1 262402 – Service Entrance Board
- .2 262413 - Switchboard

## Part 3 Execution

### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Consultant.

### 3.2 INSTALLATION

- .1 Do not ground neutral on load side of sensor.
- .2 Install phase conductors including neutral through zero sequence transformer.
- .3 Install ground fault protection system.

- .4 Make connections as indicated and in accordance with manufacturer's written recommendations.

**3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Arrange for field testing of ground fault equipment by independent testing laboratory ground fault equipment manufacturer and contractor before commissioning service.
- .3 Demonstrate simulated ground fault tests.

**3.4 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Equipment and installation for ground fault circuit interrupters (GFCI).

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2 No.144-M91(R2011), Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA PG 2.2-1999, Application Guide for Ground Fault Protection Devices for Equipment.

**1.3 SUBMITTALS**

- .1 Submittals in accordance with Section 26 05 00 – General Instructions.
- .2 Submit product data and shop drawings.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144.
- .2 Components comprising ground fault protective system to be of same manufacturer.

**2.2 GROUND FAULT PROTECTOR UNIT**

- .1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:
  - .1 Solid state ground sensing device.
  - .2 Facility for testing and reset.
  - .3 CSA Enclosure 1, flush mounted with stainless steel face plate.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International).
  - .1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches.

**1.2 SUBMITTALS**

- .1 Submit product data in accordance with Section 26 05 00 General Instructions.

**1.3 BREAKERS GENERAL**

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Breaker interrupting capacity
  - .1 600V panelboards: TBDkA symmetrical.
  - .2 250V panelboards: TBDkA symmetrical.

**1.4 THERMAL MAGNETIC BREAKERS**

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

**Part 2 Execution**

**2.1 INSTALLATION**

- .1 Install circuit breakers as indicated.

**END OF SECTION**



**Part 1 General**

**1.1 SUBMITTALS**

- .1 Submit product data in accordance with Section 26 05 00 – Electrical General Instructions.

**Part 2 Products**

**2.1 DISCONNECT SWITCHES**

- .1 Fusible/non-fusible, disconnect switch in CSA Enclosure, size as indicated.
- .2 Provision for padlocking in on-off switch position by locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated.
- .5 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Electrical General Requirements.
- .2 Indicate name of load controlled on size 4 nameplate.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install disconnect switches complete with fuses if applicable.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
- .2 CSA International
  - .1 CAN/CSA C22.2 No. 94.2-07, Enclosures for Electrical Equipment, Environmental Considerations.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 20-2010, Standard for the Installation of Stationary Fire Pumps for Fire Protection.
- .4 Underwriters' Laboratories of Canada (ULC)

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data: submit operation and maintenance data for fire pump controller and accessories for incorporation into manual.

**Part 2 Products**

**2.1 ELECTRIC MOTOR DRIVEN FIRE PUMP-CONTROLLER**

- .1 [Main] [Limited service] combined manual and automatic controller for induction motor-driven fire pump, auto-transformer starting, accommodated in drip-proof CSA Enclosure, completely wired and tested by manufacturer before shipment from factory.
- .2 To NFPA 20, and ULC listed for fire pump control.
- .3 Rating: 7.5 H, 575V, 3 phase, 60 Hz.
- .4 Controller capable of being energized automatically through pressure switch or manually by externally operable handle.
  - .1 Pressure switch set to cut in at 276 kPag and out at 310 kPag.
  - .2 Running period time set to keep motor in operation when started automatically, for minimum period of 1 minute, but not to exceed 7 minutes.
- .5 Pilot lamp to indicate circuit breaker closed and power available.
- .6 Alarm relay to energize audible and visible alarm through independent source of power to indicate circuit breaker open or power failure.
- .7 Alarm and signal devices in controller [and in remote location] to indicate trouble on controller and pumping unit, and loss of power.
- .8 Ammeter test link and voltmeter test studs.
- .9 Manual selector station, two position, marked "Automatic" and "Non-Automatic".

- .10 Means on controller to operate alarm signal continuously while pump is running.
- .11 Mark "FIRE PUMP CONTROLLER"

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1        International Electrotechnical Commission (IEC)
  - .1        IEC 947-4-1, Part 4: Contactors and motor-starters.

**1.2            SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings in accordance with Section 26 05 00 – General Instructions.
- .2        Indicate:
  - .1        Mounting method and dimensions.
  - .2        Starter size and type.
  - .3        Layout of identified internal and front panel components.
  - .4        Enclosure types.
  - .5        Wiring diagram for each type of starter.
  - .6        Interconnection diagrams.

**Part 2           Products**

**2.1           MATERIALS**

- .1        Starters: to IEC 947-4 with AC4 utilization category.

**2.2           MAGNETIC STARTER, REDUCED VOLTAGE, AUTO-TRANSFORMER**

- .1        Auto-transformer starter closed circuit transition type, of size, type, rating and enclosure type as indicated and with following components:
  - .1        Three-3 pole contactors.
  - .2        Auto-transformer with 50%, 65% and 80% taps.
  - .3        One adjustable pneumatic timing relay.
  - .4        One-3 pole manual reset overload device.
  - .5        Thermal overload protection of auto-transformers.
- .2        Accessories:
  - .1        Selector switches: standard labelled as indicated.
  - .2        Indicating lights: standard type and color as indicated.
  - .3        Auxiliary control devices as indicated.

**2.3           CONTROL TRANSFORMER**

- .1        Single phase, dry type, complete with secondary fuse, installed in with starter as indicated.
- .2        Size control transformer for control circuit load plus 20% spare capacity.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install starters, connect power and control as indicated.
- .2        Ensure correct fuses and overload devices elements installed.

**3.2                FIELD QUALITY CONTROL**

- .1        Perform tests in accordance with manufacturer's instructions.
- .2        Operate switches, contactors to verify correct functioning.
- .3        Perform starting and stopping sequences of contactors and relays.
- .4        Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

**END OF SECTION**

**Part 1 PRODUCTS****1.1 MATERIALS**

- .1 Instrument transformers: to CAN3-C13
- .2 The automatic transfer switch shall meet or exceed the requirements of CSA C22.2 No. 178-1978.
- .3 ASCO 7000 series or approved equivalent.

**1.2 CONTACTOR TYPE TRANSFER EQUIPMENT**

- .1 Provide two transfer switches:
  - .1 Rated: As per SLD.
- .2 The contactor transfer mechanism shall be inherently double throw operation, mechanically held and electrically operated by a single solenoid mechanism. It shall include a microprocessor controller to provide automatic operation. The transfer switch and controller shall be the products of the same manufacturer. The operating time shall not exceed 8 cycles including the power failure sensing.
- .3 Main contacts: silver surfaced, protected by arc disruptions means.
- .4 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.
- .5 Lever to operate switch manually when switch is isolated.
- .6 A full capacity overlapping neutral transfer contacts to be included. The neutrals are to be connected together during transfer and re-transfer operation, for a time duration not greater than 100 milliseconds to allow for coordination with ground fault relays.
- .7 The automatic transfer switch shall be provided complete with a bypass isolation switch to manually bypass the load and isolate all load and service terminals of the automatic transfer switch to permit periodic testing, perform preventive maintenance, and service of the automatic transfer switch without interruption to the load.
- .8 The isolation handle shall provide three positions, - "CLOSED", "TEST", and "OPEN". The "TEST" position shall permit electrical testing of the automatic transfer switch without disturbance to load. The "OPEN" position shall provide complete electrical isolation of the automatic transfer switch from both sources and the load without removal of conductors. With the unit in either the "TEST" or "OPEN" position, the bypass switch shall be capable of functioning as a manual transfer switch.
- .9 The bypass isolation switch shall be capable of bypassing the load to either source. The load bypass of the automatic transfer switch's connected source shall be effected without load interruption.
- .10 The automatic transfer switch shall be arranged for draw-out operation to facilitate it's removal.

**1.3 MICROPROCESSOR CONTROLLER**

- .1 The controller's sensing and logic shall be provided by a built-in microprocessor for maximum reliability.
- .2 The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.
- .4 The controller LCD display shall include a "System Status" screen which shall be accessible from any point in the menu by depressing the "ESC" key a maximum of two times. The screen shall display a clear description of the active operating sequence and switch position.
- .5 The controller shall contain a diagnostic screen for the purpose of detecting system errors. The screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
- .6 The controller shall have the ability to log data and to maintain the last 99 events, even in the event of a total loss of power. The following events shall be time and date stamped and maintained in a non volatile memory.

#### Event Logging

1. Date, time, and reason for transfer normal to emergency
2. Date, time, and reason for transfer emergency to normal
3. Date, time, and reason for engine start
4. Date, time, engine stopped
5. Date, time, emergency source available
6. Date, time, emergency source not available

#### Statistical Logging

1. Total number of transfers
2. Total number of transfers due to source failure
3. Total number of days controller is energized
4. Total number of hours both normal and emergency are available

### 1.4

#### VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING

- .1 Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified).

| <u>Parameter</u>  | <u>Sources</u> | <u>Dropout / Trip</u> | <u>Pickup / Reset</u> |
|-------------------|----------------|-----------------------|-----------------------|
| Undervoltage      | N & E, 3f      | 70 to 98%             | 85 to 100%            |
| Over voltage      | N & E, 3f      | 102 to 115%           | 2% below trip         |
| Under frequency   | N & E          | 85 to 98%             | 90 to 100%            |
| Over frequency    | N & E          | 102 to 110%           | 2% below trip         |
| Voltage unbalance | N & E          | 5 to 20%              | 1% below trip         |

- .2 Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

- .3 The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources.
- .4 Source status screens shall be provided for both normal and emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

## 1.5 TIME DELAYS

- .1 An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal outages and delay all transfer and engine starting signals.
- .2 A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
- .3 A set of DPDT gold-flashed contacts rated 10 amps, 32 vdc shall be provided for a low-voltage engine start signal.
- .4 Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
- .5 A time delay shall be provided on shutdown of engine generator for cooldown, adjustable from 0 to 60 minutes.
- .6 An in-phase monitor shall be provided in the controller. The in-phase monitor shall compare both the normal and emergency sources and shall signal the transfer switch to operate at an advance angle as determined by the frequency difference between the two sources at the time of transfer. It shall automatically adjust the phase advance angle at which the transfer operation is initiated to permit the load to be reconnected, so that inrush currents are limited to no more than normal starting current.

## 1.6 ACCESSORIES

- .1 LED indicating lights shall be provided: one to indicate when the ATS is connected to the norm source (green) and one to indicate when the ATS is connected to the emergency source (red).
- .2 LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.
- .3 Provide auxiliary contacts, closed when the transfer switch is in normal position.
- .4 Provide auxiliary contacts, closed when the transfer switch is in emergency position.
- .5 A pre-transfer signal shall be provided prior to transfer occurring in either direction. The contact will close for an adjustable period of 0 to 15 seconds prior to transfer. The circuit will reset immediately after transfer.
- .6 Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if normal source restores before the generator is ready to accept the load.
- 7. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to



emergency and/or re-transfer to normal. Both inhibit signals shall be activated through the keypad or serial port.

- .8 All customer connections shall be wired to a common terminal block to simplify field wiring connection.
- .9 A three position momentary type test switch shall be provided for the **Test / Automatic / Reset** modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or re-transfer to normal.
- 10 Engine exerciser: The controller shall provide an internal engine exerciser. It shall be possible to program up to seven different exercise routines. For each routine, it shall be possible to:
  1. Enable or disable the routine
  2. Enable or disable transfer of the load during routine.
  3. Set the start time: time of day, day of week, week of month (1st, 2nd, 3rd, 4th, alternate or every
  4. Set the duration of the exercise

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period.
- .11 Provide the ability to select "commit / no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

## 1.7 WARRANTY

- .1 Guarantee that all materials are first-class and proper for their intended use. Further guarantee is required on all materials and workmanship for a period of one (1) year from start-up or a maximum of eighteen (18) months after delivery. Make any repairs at no extra cost during this warranty period so that all equipment operates properly.

END OF SECTION

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

**1.2 RELATED SECTIONS**

- .1 Section 00 01 10 – General Instructions.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**Part 2 Products**

**2.1 LAMPS**

- .1 LED – As per lighting schedule or approved equivalent.

**2.2 BALLASTS**

- .1 LED – As per lighting schedule or approved equivalent.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Locate and install luminaries as indicated.

**3.2 WIRING**

- .1 Connect luminaries to existing lighting circuits.

**3.3 LUMINAIRE SUPPORTS**

- .1 Suspended mount luminaries.

**3.4 LUMINAIRE ALIGNMENT**

- .1 Align luminaries mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaries mounted individually parallel or perpendicular to building grid lines.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA C22.2 No.141- 02(R2007) , Unit Equipment for Emergency Lighting.
  - .2 CSA C860- 07, Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA) requirements

**1.2 SUBMITTALS**

- .1 Submit product data in accordance with Section 26 05 00 – General Instructions.
- .2 Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.
- .3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

**Part 2 Products**

**2.1 STANDARD UNITS**

- .1 Exit lights: to CSA C22.2 No.141, CSA C860 and OBC 2012.
- .2 Housing: extruded aluminum housing, brush aluminum finish.
- .3 Face and back plates: Side Lit.
- .4 Lamps: two - LED-12W, 120V, 100,000 hours.
- .5 Operation: designed for 100,000 hours of continuous operation without re-lamping.
- .6 Pictogram: Running Man, with direction arrows as indicated on drawings.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install exit lights.
- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.
- .2 CSA Group
  - .1 CSA C22.2 No.206-13, Lighting Poles.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 – General Instructions.

**Part 2 Products**

- 2.1 As per exterior lighting schedule. Or Approved equivalent. Proposed equivalent fixtures are at the discretion of the owner. Provide all shop drawings, proposed layouts and photometric calculation with tender submission, for review by owner and Engineer. Samples may be requested by owner, during review stage with successful bidder.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for roadway lighting installation in accordance with manufacturer's written instructions.

**3.2 INSTALLATION**

- .1 Install poles true and plumb, complete with brackets in accordance with manufacturer's instructions.
- .2 Install luminaires on pole and install lamps.
- .3 Check luminaire orientation, level and tilt.
- .4 Connect luminaire to lighting circuit.
- .5 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with manufacturers recommendations.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for fire alarm systems.
  - .2 Manual alarm stations.
  - .3 Automatic alarm initiating devices.
  - .4 Audible/strobe signal devices.
  - .5 Annunciators.

**1.2 REFERENCES**

- .1 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN/ULC-S524-2001, Standard for the Installation of Fire Alarm Systems.
  - .2 CAN/ULC-S525-1999, Audible Signal Device for Fire Alarm Systems.
  - .3 CAN/ULC-S528-1991, Manual Pull Stations for Fire Alarm.
- .2 National Fire Protection Agency
  - .1 NFPA 72-2002, National Fire Alarm Code.
  - .2 NFPA 90A-2002, Installation of Air Conditioning and Ventilating Systems.

**1.3 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 00 01 10 – General Instructions.
  - .2 Manufacturer's Field Reports: manufacturer's field reports specified.

**1.4 MATERIALS**

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Audible signal devices: to CAN/ULC-S525.
- .3 Manual pull stations: to CAN/ULC-S528.

**1.5 WIRING**

- .1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor. Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor
- .2 Wire to remote annunciators: No. 18 AWG minimum solid copper conductor.
- .3 Insulation 75 degrees C minimum with nylon jacket.
- .4 Colour code wiring.

**1.6 AS-BUILT RISER DIAGRAM**

- .1 Fire alarm system riser diagram: in glazed frame on black lamicaid sheet with bevelled edges, white lettering and designations, minimum size 600 x 600 mm.

**Part 2            Execution**

**2.1            MANUFACTURER'S INSTRUCTIONS**

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

**2.2            INSTALLATION**

- .1      Locate and install manual alarm stations and connect to alarm circuit wiring.
- .2      Connect alarm circuits to main control panel.
- .3      Locate and install signal bells/ horn devices and connect to signalling circuits.
- .4      Connect signalling circuits to main control panel.
- .5      Install end-of-line devices at end of alarm and signalling circuits .
- .6      Locate and install remote relay units to control fan shut down. Sprinkler system: wire alarm and supervisory switches and connect to control panel.
- .7      Provide appropriate amount of booster panel as required by selected fire alarm system manufacturer c/w 120V to booster panel location, addressable loop to unit, commissioning and verification as required.
- .8      Provide all required circuit / zone fault Isolation modules as required for a complete and operation system.
  - .1      Fault isolation modules shall be utilized when entering and leaving each fire alarm zone, as required by the National Building Code of Canada.
  - .2      Fault isolation modules, shall be located in a separate enclosure, visible and accessible at all times, located beyond the last device serving that floor area.
  - .3      Fault isolation modules incorporated in a field device shall be mounted in accordance with the requirements of the field device.
  - .4      Do not install the fault isolation modules back to back. Offset the fault isolation modules
  - .5      provide Isolation modules c/w an identifying label on the cover plate or field device.
- .9      Extent fire alarm addressable data loops to Fire pump and generator as required. Coordinate installation with selected Mechanical equipment manufacturers.
- .10     Fire alarm system to be BacNet compatible for integration of smoke control dampers, and smoke evac fans. Provide all required BacNet protocol interface cards in fire alarm panel. Fire alarm system to initiate start sequence to BAS for control of fans and dampers as required.
- .11     Refer to drawings for further requirements.

**2.3 CLEANING**

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**2.4 Acceptable manufacturers**

- .1 Siemens Fire alarm systems
- .2 Mircom Fire Alarm Systems
- .3 Edwards Fire Alarm Systems

**END OF SECTION**