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Project Manual

# **POLICE TRANSPORTABLE HOLDING CELLS**

for



Government  
of Canada

Project No. 510-10

Set No. \_\_\_\_\_

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**END OF SECTION**



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**PART 1      General**

**1.1            WORK COVERED BY CONTRACT DOCUMENTS**

- .1      Work of this Contract comprises construction of one Master and two Base Police Transportable Cell units and all associated works.
- .2      Work to include full mock-up set up of interconnected units (one Master Unit and two Base Units) for inspection and commissioning at Contractor's facilities prior to transport.
- .3      Commissioning of assembled units is to be undertaken by Commissioning agent under separate contract to owner and co-ordinated with contractor.

**1.2            WORK SEQUENCE**

- .1      Coordinate Progress Schedule.
- .2      Maintain fire access/control.

**1.3            CONTRACTOR USE OF PREMISES**

- .1      Contractor shall provide all premises required for the construction of the units to completion of highway certified trailers to be transported by others.
- .2      Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

**1.4            OWNER FURNISHED ITEMS**

- .1      Owner Responsibilities:
  - .1      Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
  - .2      Deliver supplier's bill of materials to Contractor.
  - .3      Arrange and pay for delivery to site in accordance with Progress Schedule.
  - .4      Inspect deliveries jointly with Contractor.
  - .5      Submit claims for transportation damage.
  - .6      Arrange for replacement of damaged, defective or missing items.
  - .7      Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.
- .2      Contractor Responsibilities:
  - .1      Designate submittals and delivery date for each product in progress schedule.
  - .2      Review shop drawings, product data, samples, and other submittals. Submit to Engineer notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
  - .3      Receive and unload products at site.
  - .4      Pay demurrage charges.

- .5 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
  - .6 Handle products at site, including uncrating and storage.
  - .7 Protect products from damage, and from exposure to elements.
  - .8 Assemble, install, connect, adjust, and finish products.
  - .9 Provide installation inspections required by public authorities.
  - .10 Repair or replace items damaged by Contractor or subcontractor on site (under his control).
- .3 Schedule of Owner furnished items.
- .1 none

**1.5 PERMIT AND FEES**

- .1 Obtain and pay for all permits, licenses, certificates, fees and governmental inspections or notices required for the performance of the work, including all inspections and certifications for units to be approved for highway transportation trailers in all jurisdictions in Canada.

NOTE: Permit and/or certification drawings are the property of the owner. Contractor to forward "approved" permit and/or certification drawings and a copy of permits and/or certifications to the Consultant.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not used.

END OF SECTION

**PART 1      General**

**1.1            RELATED REQUIREMENTS SPECIFIED ELSEWHERE**

- .1      Particular requirements for inspection and testing to be carried out by testing laboratory designated by Engineer are specified under various sections.

**1.2            APPOINTMENT AND PAYMENT**

- .1      Contractor will appoint and pay for services of testing laboratory for all required including the following:
  - .1      Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2      Inspection and testing performed exclusively for Contractor's convenience.
  - .3      Testing, adjustment and balancing mechanical and electrical equipment and systems.
  - .4      Mill tests and certificates of compliance.
  - .5      Tests specified to be carried out by Contractor under the supervision of Engineer.
  - .6      Additional tests specified in the following paragraph.
    - .1      Testing and certification required for highway transportation in Canada.
- .2      Testing agency appointed by Contractor to be approved by Engineer.
- .3      Additional independent inspection/testing agencies may be engaged by the Engineer for the purpose of inspecting and/or testing portions of Work.
- .4      Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Engineer to verify acceptability of corrected work.

**1.3            CONTRACTOR'S RESPONSIBILITIES**

- .1      Provide labour, equipment and facilities to:
  - .1      Provide access to Work to be inspected and tested.
  - .2      Facilitate inspections and tests.
  - .3      Make good Work disturbed by inspection and test.
  - .4      Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2      Notify the appropriate agency and Engineer sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3      Allow the inspection/testing agencies access to all portions of the Work and manufacturing and/or fabrication plants. Co-operate to provide reasonable facilities for such access.
- .4      Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

- 
- .5 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Engineer.
  - .6 Provide copy of all testing and inspection reports to Engineer within 3 days of test completion.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

END OF SECTION

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**PART 1      General**

**1.1            DESCRIPTION**

- .1      Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work.

**1.2            PROJECT MEETINGS**

**.1            ADMINISTRATIVE**

- .1      Schedule and administer project meetings throughout the progress of the work at the call of Engineer.
- .2      Prepare agenda for meetings.
- .3      Distribute written notice of each meeting minimum five (5) working days in advance of meeting date to Owner, Engineer and required attendees.
- .4      Provide physical space and make arrangements for meetings.
- .5      Preside at meetings.
- .6      Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7      Reproduce and distribute copies of minutes within three working days after meetings and transmit to meeting participants and, affected parties not in attendance, including Owner and Engineer
- .8      Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

**.2            PRECONSTRUCTION MEETING**

- .1      Within 10 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2      Senior representatives of the Owner, Engineer, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3      Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4      Agenda to include following:
  - .1      Appointment of official representative of participants in Work.
  - .2      Schedule of Work, progress scheduling
  - .3      Schedule of submission of shop drawings, samples, colour chips in accordance with Section 013300 - Submittal Procedures.
  - .4      Delivery schedule of specified equipment in accordance with Section 013100 – Project Management And Coordination.
  - .5      Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements (GC).
  - .6      Owner provided products.
  - .7      Record drawings in accordance with Section 017800 - Closeout Submittals.

- .8 Maintenance in accordance with Section 017800 - Closeout Submittals.
- .9 Take-over procedures, acceptance, and warranties in accordance with Section 017700 - Closeout Procedures and Section 017800 - Closeout Submittals.
- .10 Monthly progress claims, administrative procedures, photographs, and holdbacks (GC).
- .11 Appointment of inspection and testing agencies or firms in accordance with Section 014500 - Quality Control.
- .12 Insurances and transcript of policies (GC).
- .13 Owner security requirements
- .5 Comply with Engineer's allocation of mobilization areas of site; for field offices and sheds, access, traffic, and parking facilities.
- .6 Comply with instructions of Engineer for use of temporary utilities and construction facilities.
- .7 Coordinate field engineering and layout work with Engineer.

**.3 PROGRESS MEETINGS**

- .1 During course of Work and prior to project completion, schedule progress meetings as required.
- .2 Contractor, major Subcontractors involved in Work Engineer and Owner are to be in attendance.
- .3 Agenda to include the following:
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Problems which impede construction schedule.
  - .4 Review of off-site fabrication delivery schedules.
  - .5 Corrective measures and procedures to regain projected schedule.
  - .6 Revision to construction schedule.
  - .7 Progress schedule, during succeeding work period.
  - .8 Review submittal schedules: expedite as required.
  - .9 Maintenance of quality standards.
  - .10 Review proposed changes for affect on construction schedule and on completion date.
  - .11 Other business.

**1.3 ON-SITE DOCUMENTS**

- .1 Maintain at job site, one copy each of the following:
  - .1 Contract drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed shop drawings.
  - .5 Change orders.
  - .6 Other modifications to Contract.
  - .7 Test reports.

- .8 Copy of approved Work schedule.
- .9 Manufacturers' installation and application instructions.
- .10 Manufacturer's Certificates
- .11 Inspection Certificates

#### **1.4 SCHEDULES**

- .1 Submit preliminary construction progress schedule in accordance with Section 013216.06 – Construction Progress Schedule – Critical Path Method to Engineer coordinated with Engineer's project schedule.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work revise and resubmit as directed by Engineer.
- .4 Provide digital copy in MS Project format to Engineer.

#### **1.5 SCHEDULE OF VALUES**

- .1 Make schedule of values out in such form and supported by such evidence as Engineer may reasonably direct and when accepted by Engineer, be used as basis for applications for payment.
- .2 Include statement based on schedule of values with application for payment.
- .3 .Itemize separate line item costs for the following (but not limited to) items of Work. Item to be organized in relation to the specification section formatting.
  - .1 General Requirements
    - .1 Bonds / Permits / Insurance
  - .2 Metal Fabrications
  - .3 Structural Metal
  - .4 Rough Carpentry
  - .5 Architectural Woodwork
  - .6 Roofing
  - .7 Insulation, Vapour barriers
  - .8 Applied Fireproofing / Firestopping
  - .9 Joint Sealers
  - .10 Doors and Frames
  - .11 Swing Detention Doors
  - .12 Door Hardware
  - .13 Metal Siding
  - .14 Resilient Sheet Flooring
  - .15 Painting
  - .16 Equipment
  - .17 Mechanical
  - .18 Electrical

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## 1.6 SUBMITTALS

- .1 Make submittal to Engineer for review.
- .2 Submit preliminary shop drawings, product data and samples in accordance with Section 013300 Submittal Procedures for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Engineer.
- .3 Submit requests for payment for review, and for transmittal to Engineer.
- .4 Submit requests for interpretation of Contract Documents, and obtain instructions through Engineer.
- .5 Process substitutions through Engineer.
- .6 Process change orders through Engineer.
- .7 Deliver closeout submittals for review and preliminary inspections, for transmittal to Engineer.

## 1.7 CONSTRUCTION PHOTOGRAPHS

### .1 PROGRESS PHOTOGRAPHS

- .1 Submit construction photographs in accordance with procedures and requirements specified in this Section.
- .2 Submit progress photographs in one of the following formats:
  - .1 Digital Format
    - .1 Sizes: 2048 x 1536 pixels
    - .2 Format: .jpg, ( quality: 80% minimum)
    - .3 Compatibility: Microsoft Windows
    - .4 Identification: file name must include project name, unit name, room number, and date of exposure.  
Example: "MRB-Base-103 -10 Sept.jpg"
    - .5 Viewpoints: interior and exterior locations: viewpoints determined by Consultant.
    - .6 Frequency: monthly. E-mail digital photos to: Engineer
  - .3 All photographs to be focused and legible, with correct light exposure. Use a flash where necessary.

### .2 FINAL PHOTOGRAPHS

- .1 Submit final photographs prior to application for Substantial Completion of the Work.
- .2 Final photographs:
  - .1 Digital format, requirements same as for progress photographs, above.
    - .1 Submit all files of the final photographs. Files are to be submitted on CD-Rom or DVD-Rom format.
  - .3 Final photographs are to include each view of each room.



.3 INTERIM PHOTOGRAPHS

- .1 Contractor is required to be able to e-mail photographs within same business day to Consultant.

**1.8 CLOSEOUT PROCEDURES**

- .1 Notify Engineer when Work is considered ready for Completion.
- .2 Assemble completed units for mock-up assembly at manufacturer's location for final inspection.
- .3 Accompany Engineer on inspection to determine items listed for completion or correction.
- .4 Comply with Engineer's instructions for correction of items of Work listed in executed certificate of Substantial Performance.
- .5 Notify Engineer of instructions for completion of items of Work determined in Engineer's final inspection.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

END OF SECTION

## **Part 1            General**

### **1.1                DEFINITIONS**

- .1        Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2        Actual Finish Date (AF): point in time that Work actually ended on activity
- .3        Actual Start Date (AS): point in time that Work actually started on activity.
- .4        Bar Chart (Gantt chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars.
- .5        Baseline: original approved plan (for Project, work package, or activity), plus or minus approved scope changes.
- .6        Completion Milestones: they are firstly [Interim Certificate] [Substantial Completion] and secondly Final Certificate.
- .7        Constraint: applicable restriction that will affect performance of Project. Factors that affect activities can be scheduled.
- .8        Control: process of comparing actual performance with planned performance, analyzing variances, evaluating possible alternatives, and taking appropriate corrective action as needed.
- .9        Critical Activity: any activity on a critical path. Most commonly determined by using critical path method.
- .10       Critical Path: series of activities that determines duration of Project. In deterministic model, critical path is usually defined as those activities with float less than or equal to specified value, often zero. It is longest path through Project.
- .11       Critical Path Method (CPM): network analysis technique used to predict Project duration by analyzing which sequence of activities (which path) has least amount of scheduling flexibility (least amount of float).
- .12       Data Date (DD) : date at which, or up to which, Project's reporting system has provided actual status and accomplishments.
- .13       Duration (DU): number of work periods (not including holidays or other non-working periods) required to complete activity or other Project element. Usually expressed as workdays or work weeks.
- .14       Early Finish Date (EF): in critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can finish, based on network logic and schedule constraints. Early finish dates can change as Project progresses and changes are made to Project plan.

- 
- .15 Early Start Date (ES): in critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can start, based on network logic and schedule constraints. Early start dates can change as Project progresses and changes are made to Project Plan.
  - .16 Finish Date: point in time associated with activity's completion. Usually qualified by one of following: actual, planned, estimated, scheduled, early, late, baseline, target, or current.
  - .17 Float: amount of time that activity may be delayed from its early start without delaying Project finish date. Float is mathematical calculation, and can change as Project progresses and changes are made to Project plan. This resource is available to both Owner and Contractor.
  - .18 Lag: modification of logical relationship that directs delay in successor task.
  - .19 Late Finish Date (LF): in critical path method, latest possible point in time that activity may be completed without delaying specified milestone (usually Project finish date).
  - .20 Late Start Date (LS): in critical path method, latest possible point in time that activity may begin without delaying specified milestone (usually Project finish date).
  - .21 Lead: modification of logical relationship that allows acceleration of successor task.
  - .22 Logic Diagram: see Project network diagram.
  - .23 Master Plan: summary-level schedule that identifies major activities and key milestones.
  - .24 Milestone: significant event in Project, usually completion of major deliverable.
  - .25 Monitoring: capture, analysis, and reporting of Project performance, usually as compared to plan.
  - .26 Near-Critical Activity: activity that has low total float.
  - .27 Non-Critical Activities: activities which when delayed, do not affect specified Contract duration.
  - .28 Project Control System: fully computerized system utilizing commercially available software packages.
  - .29 Project Network Diagram: schematic display of logical relationships of Project activities. Always drawn from left to right to reflect Project chronology.
  - .30 Project Plan: formal, approved document used to guide both Project execution and Project control. Primary uses of Project plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines. Project plan may be summary or detailed.
  - .31 Project Planning: development and maintenance of Project Plan.

- .32 Project Planning, Monitoring and Control System: overall system operated by Owner and Engineer to enable monitoring of Project Work in relation to established milestones.
- .33 Project Schedule: planned dates for performing activities and planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy project objectives. Monitoring and control process involves using project schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .34 Quantified days duration: working days based on 5 day work week, discounting statutory holidays.
- .35 Risk: uncertain event or condition that, if it occurs, has positive or negative effect on Project's objectives.
- .36 Scheduled Finish Date (SF): point in time that Work was scheduled to finish on activity. Scheduled finish date is normally within range of dates delimited by early finish date and late finish date.
- .37 Scheduled Start Date (SS): point in time that Work was scheduled to start on activity. Scheduled start date is normally within range of dates delimited by early start date and late start date.
- .38 Start Date: point in time associated with activity's start, usually qualified by one of following: actual, planned, estimated, scheduled, early, late, target, baseline, or current.
- .39 Work Breakdown Structure (WBS): deliverable-oriented grouping of project elements that organizes and defines total Work scope of Project. Each descending level represents increasingly detailed definition of Project Work.

## **1.2 SYSTEM DESCRIPTION**

- .1 Construction Progress Schedule (Project Time Management): describes processes required to ensure timely completion of Project. These processes ensure that various elements of Project are properly co-ordinated. It consists of planning, time estimating, scheduling, progress monitoring and control.
- .2 Planning: this is most basic function of management, that of determining presentation of action and is essential.
  - .1 It involves focusing on objective consideration of future, and integrating forward thinking with analysis; therefore, in planning, implicit assumptions are made about future so that action can be taken today.
  - .2 Planning and scheduling facilitates accomplishment of objectives and should be considered continuous interactive process involving planning, review, scheduling, analysis, monitoring and reporting.
- .3 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made. This implies progressively more reliability of scheduling data. Detail Project schedule is used for analysis and progress monitoring.

- .4 Ensure project schedule efficiencies through monitoring.
  - .1 When activities begin on time and are performed according to estimated durations without interruptions, original Critical Path will remain accurate. Changes and delays will however, create an essential need for continual monitoring of Project activities.
  - .2 Monitor progress of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.
  - .3 Monitoring should be done sufficiently often so that causes of delays are immediately identified and removed if possible.
- .5 Project monitoring and reporting: as Project progresses, keep team aware of changes to schedule, and possible consequences. In addition to Bar Charts and CPM networks, use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.
  - .1 Narrative reporting begins with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.

### **1.3 CPM REQUIREMENTS**

- .1 Ensure Master Plan and Detail Schedule are practical and remain within specified Contract duration.
- .2 Master Plan and Detail Schedule deemed impractical by Owner or Engineer are revised and resubmitted for approval.
- .3 Acceptance of Master Plan and Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract. Duration of Contract may only be changed through bilateral Agreement.
- .4 Consider Master Plan and Detail Schedule deemed practical by Owner and Engineer, showing Work completed in less than specified Contract duration, to have float.
- .5 First Milestone on Master Plan and Detail Schedule will identify start Milestone with an "ES" constraint date equal to Award of Contract date.
- .6 Calculate dates for completion milestones from Plan and Schedule using specified time periods for Contract.
- .7 Calculations on updates to be such that if early finish of Interim Certificate falls later than specified Contract duration then float calculation to reflect negative float.
- .8 Delays to non-critical activities, those with float may not be basis for time extension.
- .9 Allow for and show Master Plan and Detail Schedule adverse weather conditions normally anticipated. Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.

- .10 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration. Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.
- .11 Arrange participation on and off site of subcontractors and suppliers, as required by Owner and Engineer, for purpose of network planning, scheduling, updating and progress monitoring. Approvals by Owner or Engineer of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.
- .12 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

#### **1.4 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures
- .2 Include costs for execution, preparation and reproduction of schedule submittals in bid documents.
- .3 Submit letter ensuring that schedule has been prepared in co-ordination with major sub-contractors.
- .4 Refer to article "Progress monitoring and reporting" of this specification Section for frequency of Project control system submittals.

#### **1.5 QUALITY ASSURANCE**

- .1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including Commissioning.

#### **1.6 MASTER PLAN**

- .1 Structure and base CPM construction networks system on WBS coding in order to ensure consistency throughout Project.
- .2 Prepare comprehensive construction Master Plan (CPM logic diagram) and dependent Cash Flow Projection.
  - .1 Master Plan will be used as baseline.
    - .1 Revise baseline as conditions dictate and as required.
- .3 Reconcile revisions to Master Plan and Cash Flow Projections with previous baseline to provide continuous audit trail.
- .4 Initial and subsequent Master Plans will include:
  - .1 Bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.
  - .2 Network diagram showing coding, activity sequencing (logic), total float, early/late dates, current status and durations.

- .3 Actual/projected monthly cash flow: expressed monthly and shown in both graphical and numerical form.

**1.7 PROGRESS MONITORING AND REPORTING**

- .1 On ongoing basis, Detail Schedule on job site must show "Progress to Date". Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Owner and Engineer monthly to establish progress on each current activity shown on applicable networks.
- .2 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.
- .3 Perform Detail Schedule update monthly with status dated (Data Date) on last working day of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.
- .4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.
- .5 Submit to Owner and Engineer copies of updated Detail Schedule.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

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**PART 1      General**

**1.1            ADMINISTRATIVE**

- .1      Submit to Engineer submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2      Work affected by submittal shall not proceed until review is complete.
- .3      Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4      Where items or information is not produced in SI Metric units converted values are acceptable.
- .5      Review submittals prior to submission to Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.
- .6      Notify Engineer, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7      Verify field measurements and affected adjacent Work are coordinated.
- .8      Contractor's responsibility for errors and omissions in submission is not relieved by Engineer's review of submittals.
- .9      Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer review.
- .10     Keep one reviewed copy of each submission on site.

**1.2            SHOP DRAWINGS AND PRODUCT DATA**

- .1      The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2      The Contractor shall arrange for the preparation of clearly identified shop drawings, each shop drawing shall display name and file number of project, as called for by the Contract Documents or as the Engineer may reasonably request.
- .3      Submit three copies of shop drawings when format is 11" x 17" or smaller. Submit shop drawings on a reproducible format and three copies when format is larger than 11" x 17". One copy of 11" x 17" format or smaller shop drawings and the reproducible format will be returned to the Contractor to produce his required copies at his expense.



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- .4 Submit copies of shop drawings for structural work directly to the Structural Engineer. Submit copies of shop drawings for mechanical work directly to the Mechanical Engineer. Submit copies of shop drawings for electrical work directly to the Electrical Engineer.  
\*NOTE: Copy of transmittal to Engineer.
  - .5 All shop drawings shall be submitted with a “continuous” format transmittal indicating:
    - .1 Reference specification section
    - .2 Shop drawing number
    - .3 Shop drawing description
    - .4 Number of copies sent
    - .5 Date sent
    - .6 Name sent by
    - .7 Name sent to
    - .8 Date received
    - .9 Number of copies received
    - .10 Additional information as the Contractor may require.
  - .6 Where applicable, identify each detail on the shop drawing by referring to sheet and detail numbers shown on the Contract Documents.
  - .7 Allow 5 working days for Engineer's review of each submission.
  - .8 Adjustments made on shop drawings by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.
  - .9 Submissions shall include:
    - .1 Date and revision dates.
    - .2 Project title and number.
    - .3 Name and address of:
      - .1 Subcontractor.
      - .2 Supplier.
      - .3 Manufacturer.
    - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
    - .5 Details of appropriate portions of Work as applicable:
      - .1 Fabrication.
      - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
      - .3 Setting or erection details.
      - .4 Capacities.
      - .5 Performance characteristics.
      - .6 Standards.
      - .7 Operating weight.
      - .8 Wiring diagrams.

- .9 Single line and schematic diagrams.
- .10 Relationship to adjacent work.
- .10 After Engineer's review, distribute copies.
- .11 Submit 3 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Engineer where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Delete information not applicable to project.
- .13 Supplement standard information to provide details applicable to project.
- .14 Facsimile Shop Drawings will not be accepted.
- .15 Maximum sheet size 860 x 1120 mm.
- .16 All submitted shop drawings and manufacturer's data are to be compiled in both a hard copy and a soft copy (PDF) submission and submitted with the maintenance manuals.

### **1.3 SAMPLES**

- .1 Submit for review samples in as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Engineer's business address.
- .3 Notify Engineer in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.
- .6 Make changes in samples which Engineer may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

### **1.4 MOCK-UPS**

- .1 Erect mock-ups in accordance with 014500 - Quality Control.

### **1.5 PROGRESS PHOTOGRAPHS**

- .1 Submit progress photographs in accordance with Section 013100 Project Management and Coordination.

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**1.6 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status, and transcription of insurances.

**1.7 MANUFACTURER'S FIELD SERVICES REPORTS**

- .1 Submit copies of written reports following all attendance at the site by the manufacturer's representative.
- .2 Submit copies to the Engineer, Contractor and appropriate Sub-Contractors.
- .3 Field Service reports shall include (as a minimum):
  - .1 Name of Report
  - .2 Date of attendance at the site
  - .3 List all attendees at time of attendance to the site
  - .4 Observations of progress of the Work
  - .5 Recommendations or directives made to the Contractor and/or Subcontractors and actions required to ensure acceptable application or construction.
- .4 Submit copies of manufacturer's standard recommendations for application / installation with initial field services report.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

END OF SECTION

**Part 1            General**

**1.1                REFERENCES**

- .1        Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2        Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1        Material Safety Data Sheets (MSDS).
- .3        Province of Manufacture
  - .1        Occupational Health and Safety Act, current legislation

**1.2                SUBMITTALS**

- .1        Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .3        Submit copies of incident and accident reports.
- .4        Submit WHMIS MSDS - Material Safety Data Sheets.

**1.3                FILING OF NOTICE**

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

**1.4                SAFETY ASSESSMENT**

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

**1.5                REGULATORY REQUIREMENTS**

- .1        Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

**1.6                GENERAL REQUIREMENTS**

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

**1.7                RESPONSIBILITY**

- .1        Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

## **1.8 COMPLIANCE REQUIREMENTS**

- .1 Comply with Occupational Health and Safety Regulations, current legislation.

## **1.9 UNFORSEEN HAZARDS**

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

## **1.10 HEALTH AND SAFETY CO-ORDINATOR**

- .1 Identify competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
  - .1 Have minimum 2 years' site-related working experience specific to activities associated with this work.
  - .2 Have working knowledge of occupational safety and health regulations.
  - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
  - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
  - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

## **1.11 POSTING OF DOCUMENTS**

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

## **1.12 CORRECTION OF NON-COMPLIANCE**

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

## **1.13 WORK STOPPAGE**

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

**Part 2            Products**

**2.1                NOT USED**

.1                Not used.

**Part 3            Execution**

**3.1                NOT USED**

.1                Not used.

**END OF SECTION**

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**PART 1      General**

**1.1            INSPECTION**

- .1      Allow Engineer access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2      Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Engineer instructions, or law of Place of Work.
- .3      If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4      Engineer may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Engineer shall pay cost of examination and replacement.

**1.2            INDEPENDENT INSPECTION AGENCIES**

- .1      Independent Inspection/Testing Agencies will be engaged by Contractor for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Contractor.
- .2      Provide equipment required for executing inspection and testing by appointed agencies.
- .3      Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4      If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Engineer at no cost to Engineer. Pay costs for retesting and re-inspection.

**1.3            ACCESS TO WORK**

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

**1.4            PROCEDURES**

- .1      Notify appropriate agency and Engineer in advance of requirement for tests, in order that attendance arrangements can be made.
- .2      Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

## **1.5 REJECTED WORK**

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Engineer as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Engineer it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Engineer.

## **1.6 REPORTS**

- .1 Submit 4 copies of inspection and test reports to Engineer.
- .2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

## **1.7 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as may be requested.
- .2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Engineer and may be authorized as recoverable.

## **1.8 MOCK-UPS**

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Construct in all locations acceptable to Engineer.
- .3 Prepare mock-ups for Engineer's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 Mock-ups may remain as part of Work.
- .6 Prepare Mock-up assembly of units at Contractor's location for final inspection by Engineer.



**1.9 MILL TESTS**

- .1 Submit mill test certificates as required of specification Sections.

**1.10 EQUIPMENT AND SYSTEMS**

- .1 Submit adjustment and balancing reports for mechanical, electrical systems.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

END OF SECTION

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**PART 1      General**

**1.1            REFERENCE STANDARDS**

- .1      Within text of each specifications section, reference may be made to reference standards. List of standards reference writing organizations is contained in Section 014200 - References.
- .2      Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3      If there is question as to whether any product or system is in conformance with applicable standards, Owner reserves right to have such products or systems tested to prove or disprove conformance.
- .4      Cost for such testing will be born by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5      Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

**1.2            QUALITY**

- .1      Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2      Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3      Should any dispute arise as to quality or fitness of products, decision rests strictly with Engineer based upon requirements of Contract Documents.
- .4      Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5      Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

**1.3            AVAILABILITY**

- .1      Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Engineer of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

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- .2 In event of failure to notify Engineer at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Engineer reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

#### **1.4 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Engineer.
- .9 Touch-up damaged factory finished surfaces to Engineer's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

#### **1.5 TRANSPORTATION**

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

#### **1.6 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Engineer in writing, of conflicts between specifications and manufacturer's instructions, so that Engineer may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Engineer to require removal and re-installation at no increase in Contract Price or Contract Time.

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**1.7 QUALITY OF WORK**

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

**1.8 CO-ORDINATION**

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

**1.9 CONCEALMENT**

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Engineer if there is interference. Install as directed by Engineer.

**1.10 REMEDIAL WORK**

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

**1.11 LOCATION OF FIXTURES**

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Engineer of conflicting installation. Install as directed.

**1.12 FASTENINGS**

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

### **1.13 FASTENINGS - EQUIPMENT**

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

### **1.14 PROTECTION OF WORK IN PROGRESS**

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

## **PART 2 Products**

### **2.1 ACCEPTABLE PRODUCTS**

- .1 Products listed as acceptable products in various sections are to be used as a guide and does not imply exclusion of unlisted manufacturers, models or materials.
- .2 Acceptable products means that items named and specified by manufacturers reference meets the specification in all aspects and is acceptable to the Engineer.
- .3 Equipment or materials proposed shall meet the same standards. The decision of the Engineer is final regarding the approval of products proposed.

### **2.2 NO SUBSTITUTIONS**

- .1 All products listed "No Substitutions" in various sections are to be supplied as specified.

## **PART 3 Execution**

### **3.1 NOT USED**

- .1 Not Used.

END OF SECTION

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**PART 1      General**

**1.1            SUBMITTALS**

- .1      Submit written request in advance of cutting or alteration which affects:
  - .1          Structural integrity of any element of Project.
  - .2          Integrity of weather-exposed or moisture-resistant elements.
  - .3          Efficiency, maintenance, or safety of any operational element.
  - .4          Visual qualities of sight-exposed elements.
  - .5          Work of Owner or separate contractor.
  
- .2      Include in request:
  - .1          Identification of Project.
  - .2          Location and description of affected Work.
  - .3          Statement on necessity for cutting or alteration.
  - .4          Description of proposed Work, and products to be used.
  - .5          Alternatives to cutting and patching.
  - .6          Effect on Work of Owner or separate contractor.
  - .7          Written permission of affected separate contractor.
  - .8          Date and time work will be executed.

**1.2            MATERIALS**

- .1      Required for original installation.
  
- .2      Change in Materials: Submit request for substitution in accordance with Section 013300 - Submittal Procedures.

**1.3            PREPARATION**

- .1      Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
  
- .2      After uncovering, inspect conditions affecting performance of Work.
  
- .3      Beginning of cutting or patching means acceptance of existing conditions.
  
- .4      Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
  
- .5      Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

**1.4            EXECUTION**

- .1      Execute cutting, fitting, and patching including excavation and fill, to complete Work.
  
- .2      Fit several parts together, to integrate with other Work.

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- .3 Uncover Work to install ill-timed Work.
  - .4 Remove and replace defective and non-conforming Work.
  - .5 Remove samples of installed Work for testing.
  - .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
  - .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
  - .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
  - .9 Restore work with new products in accordance with requirements of Contract Documents.
  - .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
  - .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.
  - .12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
  - .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

END OF SECTION



**PART 1      General**

**1.1            PROJECT CLEANLINESS**

- .1      Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2      Remove waste materials from site at regularly scheduled times or dispose of as directed by Engineer. Do not burn waste materials on site.
- .3      Provide and use clearly marked separate bins for recycling. Refer to Section 017419 – Construction Waste Management and Disposal.
- .4      Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
- .5      Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .6      Provide adequate ventilation during use of volatile or noxious substances.
- .7      Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .8      Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

**1.2            FINAL CLEANING**

- .1      Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .2      Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .3      Remove waste products and debris other than that caused by Owner or other Contractors.
- .4      Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .5      Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors, doors and ceilings
- .6      Clean lighting reflectors, lenses, and other lighting surfaces.
- .7      Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .8      Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

- .9 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .10 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .11 Clean roofs, downspouts, and drainage systems.
- .12 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

END OF SECTION

---

**PART 1      General**

**1.1            INSPECTION AND DECLARATION**

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1 Notify Engineer in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
  - .2 Request Engineer's Inspection.
- .2 Engineer's Inspection: Engineer and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
  - .1 Work has been completed and inspected for compliance with Contract Documents.
  - .2 Defects have been corrected and deficiencies have been completed.
  - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
  - .4 Certificates required by Boiler Inspection Branch, Fire Commissioner, Utility companies, other Authorities having Jurisdiction have been submitted.
  - .5 Operation of systems have been demonstrated to Owner's personnel.
  - .6 Work is complete and ready for Final Inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Engineer, and Contractor. If Work is deemed incomplete by Engineer, complete outstanding items and request re-inspection.

**PART 2      Products**

**2.1            NOT USED**

- .1 Not Used.

**PART 3      Execution**

**3.1            NOT USED**

- .1 Not Used.

END OF SECTION

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**PART 1      General**

**1.1            SUBMISSION**

- .1 Two weeks prior to Substantial Performance of the Work, submit to the Engineer:
  - .1 Four final copies of operating and maintenance manuals in English.
    - .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
    - .2 Copy will be returned with Engineer's comments.
    - .3 Revise content of documents as required prior to final submittal.
  - .2 As-built drawings
  - .3 Final Survey
  - .4 Spare parts as indicated, complete with docket list.
  - .5 Maintenance Materials as specified, complete with docket list.
  - .6 Special Tools as specified.
  - .7 One copy of all shop drawings organized into a 3-ring binder.
- .2 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .3 If requested, furnish evidence as to type, source and quality of products provided.
- .4 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .5 Pay costs of transportation.

**1.2            FORMAT**

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf [219 x 279] mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine. All binders are to match.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.

- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide Construction photographs on CD.

### **1.3 CONTENTS - EACH VOLUME**

- .1 Table of Contents: provide title of project;
  - .1 date of submission; names,
  - .2 addresses, and telephone numbers of Engineers and Contractor with name of responsible parties;
  - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 014500 - Quality Control.
- .6 Training: Refer to Section 017900 - Demonstration and Training.

### **1.4 AS-BUILTS AND SAMPLES**

- .1 In addition to requirements in General Conditions, maintain at the site for Engineer one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to the Contract.
  - .5 Reviewed shop drawings, product data, and samples.
  - .6 Field test records.
  - .7 Inspection certificates.
  - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Engineer.

## **1.5 RECORDING ACTUAL SITE CONDITIONS**

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

## **1.6 EQUIPMENT AND SYSTEMS**

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with Engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.

- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 014500 - Quality Control and 019100 - Commissioning.
- .15 Additional requirements: As specified in individual specification sections.

## **1.7 MATERIALS AND FINISHES**

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

## **1.8 SPARE PARTS**

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.

- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

**1.9 MAINTENANCE MATERIALS**

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

**1.10 SPECIAL TOOLS**

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.

**1.11 STORAGE, HANDLING AND PROTECTION**

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

**1.12 WARRANTIES AND BONDS**

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within [ten] days after completion of the applicable item of work.



- 
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
  - .5 Verify that documents are in proper form, contain full information, and are notarized.
  - .6 Co-execute submittals when required.
  - .7 Retain warranties and bonds until time specified for submittal.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

END OF SECTION

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**PART 1      General**

**1.1            DESCRIPTION**

- .1      Demonstrate operation and maintenance of equipment and systems to Owner's personnel at substantial performance.
- .2      Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

**1.2            QUALITY CONTROL**

- .1      When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

**1.3            SUBMITTALS**

- .1      Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Engineer's approval.
- .2      Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3      Give time and date of each demonstration, with list of persons present.
- .4      Record in video all instructions given, and include 2 digital copies with the maintenance manuals.
- .5      Circulate attendance sheet with printed name, signature, and position of each attendee, including the instructor. Include copies with maintenance manuals.

**1.4            CONDITIONS FOR DEMONSTRATIONS**

- .1      Equipment has been inspected and put into operation in accordance with appropriate Section.
- .2      Testing, adjusting, and balancing has been performed in accordance with Section 019100 - Commissioning and equipment and systems are fully operational.
- .3      Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

**1.5            PREPARATION**

- .1      Verify that conditions for demonstration and instructions comply with requirements.
- .2      Verify that designated personnel are present.

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**1.6 DEMONSTRATION AND INSTRUCTIONS**

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.
- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

**1.7 TIME ALLOCATED FOR INSTRUCTIONS**

- .1 Ensure amount of time required for instruction of each item of equipment or system as follows:
  - .1 Section 083483 – Hinged Safety Glass Doors: 1 hours of instruction.
  - .2 Section 087110 - Door Hardware - General 1 hours of instruction.
  - .3 Section 087173 – Special Function Hardware: 1 hours of instruction.
  - .4 Section 230500 – Common Work Results - Mechanical.
  - .5 Section 260501 – Common Work Results - Electrical.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

END OF SECTION

## **Part 1 – GENERAL**

### **1.1 COMMISSIONING AGENCY**

The commissioning agency (CA) has been contracted directly with the owner for this project. The CA has overall responsibility for planning and coordinating the commissioning process. However commissioning involves all parties to the design and construction process, including the contractor.

### **1.2 CONTRACTOR RESPONSIBILITY**

This Section of the specifications defines the contractor's responsibilities with respect to the commissioning process. Each contractor and sub-contractor shall review this Section, and shall include in their bids for carrying out the work described, as it applies to each Division and Section of these specifications, individually and collectively.

### **1.3 DESCRIPTION OF WORK**

The purpose of the commissioning process is to provide the owner/operator of the facility with assurance that the mechanical systems and lighting controls have been installed according to the contract documents, and operate within the performance guidelines set out in the owner's operational requirements and these specifications. The CA will provide the owner with an unbiased, objective view of the system's installation, operation, and performance. The commissioning process does not take away or reduce the responsibility of the installing contractors to provide a finished product, installed and fully functional in accordance with the contract documents.

Commissioning is intended to enhance the quality of system start-up and aid in the orderly completion and transfer of systems for beneficial use by the owner. The CA will be the leader of the commissioning team, planning and coordinating all commissioning activities in conjunction with the design professionals, construction manager, subcontractors, manufacturers and equipment suppliers.

The General Contractor, Mechanical Contractor (also referred to as Divisions 23, 25), all Divisions 23, 25 sub-contractors, and the Electrical Contractor (also referred to as Division 26), Controls and TAB Contractors shall be responsible for cooperating, and coordinating their work, with the CA. They shall also be responsible for carrying out all the physical activities required for installation of components and systems, system verification checks (SVC) functional performance testing (FPT) and operating them during the commissioning process as required in this Section.

System Verification Checks consist of visual verification of the equipment and component in accordance with the SVC lists that will be generated by the Mechanical Engineer upon review of the shop drawings and distributed to the Contractors and CA.

Functional Performance Testing will be carried out after the SVC have confirmed all systems are ready for start-up and operational testing. FPT consists of operational testing under all normal operating conditions and failure modes in accordance with the SVC lists that will be generated by the Mechanical Engineer upon review of the shop drawings and distributed to the Contractors and CA.

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#### **1.4 RELATED DOCUMENTS**

Drawings and general provisions of the contract, including general and supplementary conditions, general mechanical provisions and applicable Divisions 23, 25 and 26 Specification sections, apply to work of this section.

### **Part 2 – PRODUCTS**

#### **2.1 SYSTEMS TO BE COMMISSIONED**

HVAC and lighting control systems installed under this contract are to be inspected, tested, signed off as complete and operational, and operated for commissioning agency verification as described in Part 3 of this Section. This includes, but is not necessarily limited to the work listed for each system. The foregoing includes all the following:

- 1 Air handling systems, including variable air volume delivery equipment - Work includes installation inspections and checks; checkout and startup by manufacturer's representative as specified; documented capacity tests, for heating, cooling, air flow and static pressures; operation of all control sequences; sound level.
- 2 Exhaust fans - Work includes checks on installation (including dampers and other accessories), rotation, sound levels, motor current draw, and airflows and pressures.
- 3 Heating systems, duct heaters, forced flow heaters and humidifiers - Work includes installation inspections and functional performance tests.
- 4 HVAC Controls System – Work includes inspections and checks of installation and operation of all devices; complete operation of all controls sequences, in coordination with commissioning of all controlled systems.
- 5 Lighting control - Work includes inspections and checks of installation and operation of all devices.

The contractor shall be responsible for carrying out all work required for commissioning these systems that is defined as a contractor responsibility in Part 3 of this Section.

#### **2.2 SYSTEM VERIFICATION CHECKLISTS**

System Verification Checklists will be submitted to the contractor after the equipment submittals have been reviewed by the consultants. The Contractor is responsible for all pre-start-up inspections, and start-up procedures. BAS controls shall include a point-by-point verification.

#### **2.3 FUNCTIONAL PERFORMANCE TEST CHECKLISTS**

Functional Performance Checklists will be submitted to the contractor after the equipment submittals have been reviewed by the consultants. The Contractor is responsible for all operational procedures required to test and commission the systems included in the project. FPT's shall be performed for all equipment and system components. Contractor shall make allowances for all operational testing, including manufacturers requirements.

**2.4 OFF-SEASON FUNCTIONAL PERFORMANCE TESTS**

Contractor shall perform off-season tests after occupancy to verify the system and equipment operations under peak conditions in the opposite season. FPT's performed under peak summer conditions shall be off-season tested under peak winter conditions.

**2.5 MEMBERS OF THE COMMISSIONING TEAM**

During the commissioning process, participation of team members will generally be required as noted in the following table (with abbreviations as noted in brackets in the preceding list of team members).

- CA Commissioning Authority
- M Mechanical Contractor
- TAB Testing Adjusting and Balancing Contractor
- E Electrical Contractor

Note: The mechanical contractor, indicated by "M", includes all mechanical subcontractors or suppliers whose participation is required for commissioning a particular system or piece of equipment.

EQUIPMENT/SYSTEM DESCRIPTION	TEAM MEMBERS				
	CA	M	TAB		E
Air handlers	X	X	X		X
Exhaust fans	X	X	X		X
Building temperature controls	X	X			X
Heating systems	X	X			X
Lighting control	X				X

**Part 3 – EXECUTION**

**3.1 COMMISSIONING RESPONSIBILITIES – NON-CONTRACTOR TEAM MEMBERS**

**3.1.1 *Introduction***

A multi-disciplinary team carries out commissioning. The commissioning responsibilities of some non-contractor team members during the construction and acceptance phases of the project are provided here for information, and to provide some context for the overall process.

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### ***3.1.2 Commissioning Agency Responsibilities***

The commissioning agency will:

- plan, organize and implement the commissioning process as specified herein,
- prepare the commissioning plan, and ensure its distribution for review and comment,
- revise the commissioning plan as required during construction,
- chair commissioning meetings, and prepare and distribute minutes to all commissioning team members, whether or not they attended the meeting,
- in conjunction with the General Contractor, coordinate commissioning activities among all contractors, sub-trades and suppliers,
- prepare commissioning input to the schedule,
- monitor System Verification Checks, and ensure the results are documented as the checks are done,
- observe all start-ups and initial system operations tests and checks,
- direct the contractors to operate equipment and systems as required to ensure that all required Functional Performance Tests are carried out for verification purposes,
- witness all Functional Performance Tests and document the results,
- prepare and submit a Commissioning Report which documents all checks and tests done throughout the Commissioning process, and the results obtained from each, and
- ensure all required O&M manuals, instructions and demonstrations are provided to the Owner's designated operating staff.
- prepare a re-commissioning manual for the owner's use.

### ***3.1.3 Mechanical Engineer Responsibilities***

The Mechanical Engineer will generate the SVC and FPT lists, review the Commissioning Plan, and will participate, as appropriate, in on-site commissioning meetings. During the acceptance phase of the commissioning process, the Mechanical Engineer may be on site to review commissioning documentation, to witness Functional Performance Tests, and to analyze the installation and its performance.

### ***3.1.4 Electrical Engineer Responsibilities***

The Electrical Engineer will review the Commissioning Plan, and will participate, as appropriate, to ensure that electrical system provisions for the proper operation of the HVAC and lighting control systems are completed.

### ***3.1.5 Owner's Responsibilities***

The Owner will ensure the availability of operating staff for all scheduled instruction and demonstration sessions. The staff will possess sufficient skills and knowledge to operate and maintain the installation following attendance at these sessions.

The Owner will also ensure the appropriate involvement of the consultants as required, in the commissioning process and for training of O&M staff.

### **3.2 COMMISSIONING RESPONSIBILITIES – GENERAL CONTRACTOR**

The General Contractor has responsibility to ensure the overall completion of the Work. In this regard, he shall:

1. Participate as required in the HVAC commissioning process;
2. ensure the Mechanical Contractor performs all assigned HVAC commissioning responsibilities as specified;
3. ensure the testing, adjusting and balancing (TAB) agency performs HVAC commissioning responsibilities as specified;
4. ensure the Electrical Contractor performs all assigned HVAC commissioning responsibilities as specified;
5. ensure the cooperation and participation in the HVAC commissioning process of all other sub-contractors as applicable;
6. ensure training and demonstration requirements are met.

The General Contractor shall assign a representative to the commissioning team, and submit the person's name to the commissioning agency, within one (1) month of the award of the contract.

The representative shall have the authority to make decisions on behalf of the General Contractor as they relate to the organization and scheduling of HVAC commissioning. The representative shall facilitate communications among all contractors and suppliers and other commissioning team members, and shall foster the necessary cooperative action. One specific responsibility shall be to attend commissioning meetings, and ensure action items arising from them are attended to as required to allow the commissioning process to proceed on schedule.

Preparation of the commissioning schedule by the CA depends on reasonable delivery of the contractor's construction schedule (and or mech contractor's schedule below) by the contractor and project schedule by project management (*or Construction Management as appropriate*) team.

In the event that any scheduled equipment or system start-ups or FPT's are terminated because the CA or the mechanical engineer discover deficient or incomplete work, or due to the non-attendance of required contractor or supplier personnel, the contractor or sub-contractor responsible for the conditions that caused the termination shall also be responsible for paying reasonable costs of time and travel expenses of any or all of the following representatives who were physically present for the purpose of witnessing the start-up or the FPT: the CA, the mechanical engineer, the electrical engineer, and the owner. The owner may provide a statement to the General Contractor identifying the specific activity that was terminated, the scheduled date, and a list of those in attendance, along with their reasonable time and travel expense costs.

### **3.3 COMMISSIONING RESPONSIBILITIES – DIVISION 23, 25 (MECHANICAL) CONTRACTOR**

The mechanical contractor, and all the sub-contractors and suppliers within Divisions 23, 25 shall cooperate with the CA, and other commissioning team members, to facilitate the successful completion of the commissioning process.



The contractor shall assign a representative to the commissioning team, and submit the person's name to the commissioning agency, within one (1) month of the award of the contract. The representative shall have the authority to make decisions on behalf of the mechanical contractor as they relate to the organization and scheduling of HVAC commissioning. The representative shall ensure communications between Divisions 23, 25 contractors and suppliers and all other commissioning team members, and shall foster the necessary cooperative action. One specific responsibility shall be to attend commissioning meetings, and ensure action items arising from them are attended to as required to allow the commissioning process to proceed on schedule.

The Mechanical Contractor, and all mechanical sub-contractors and suppliers, shall cooperate with the CA in carrying out the HVAC commissioning process. In this context, the Mechanical Contractor shall:

1. Each contractor and sub-contractor in this division shall include in their quotes the cost of participating in the commissioning process as specified herein.
2. Ensure the controls (BAS) contractor performs HVAC commissioning responsibilities (where BAS contractor is a sub to the mechanical contractor).
3. Provide detailed sequence of operation for stand-alone controllers. Review sequence with mechanical engineer and modify where directed.
4. Provide instruction and demonstrations for the Owner's designated operating staff, in conjunction with the commissioning agency and mechanical engineer, and with the participation of qualified technicians from major equipment suppliers and the controls contractor.
5. Include requirements for submittal data, O&M data, and training information in each purchase order or sub-contract written.
6. Ensure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, and water treatment as applicable.
7. Ensure participation of major equipment manufacturing in appropriate start-up, testing and training activities.
8. Attend HVAC commissioning meetings scheduled by the CA.
9. Notify the CA a minimum of two weeks in advance of scheduled equipment and system start-ups, so that the CA may witness system verifications, and equipment and system start-ups.
10. Provide sufficient personnel to assist the CA as required during system verification and functional performance testing.
11. Prior to start-up, inspect, check and confirm the correct and complete installation of all equipment and systems for which SVC's are included in the commissioning plan. Document the results of all inspections and checks on the checklists and sign them. If deficient or incomplete work is discovered, ensure corrective action is taken and re-check until the results are satisfactory and the system is ready for safe startup.
12. Notify the CA a minimum of two weeks in advance, of the time for start of the TAB work. Attend the initial TAB meeting for review of the TAB procedures.
13. Provide equipment and systems start-up resources as specified and required. If during an attempted equipment or system start-up, deficient or incomplete work is discovered that would preclude safe operation, the start-up shall be aborted until corrective action has been taken. Ensure such action is taken and verified before re-scheduling a new start-up. Those responsible for deficient or incomplete work will be responsible for costs in accordance with 3.2 in this Section.
14. Complete Start-up sheets and submit to CA.

15. Carry out performance checks to ensure that all equipment and systems fully functional and ready for the CA to witness formal FPT's.
16. Operate equipment and systems for FPT's in accordance with the commissioning plan and as directed by the CA. If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, the FPT's will be stopped by the CA. Those responsible for deficient or incomplete work will be responsible for costs in accordance with Section 3.2. Ensure that all corrections necessary for full and complete system operation as specified are completed; then with the ATC contractor and other applicable sub-contractors, carry out Functional Performance Checks to confirm correct operation before applying to the CA to reschedule the FPTs for the system in question.
17. Prepare preliminary schedule for mechanical system orientation and inspections. O & M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up TAB, and task completion for use by the CA. Update schedule as appropriate throughout the construction period.
18. Attend all O&M staff training sessions.
19. Conduct mechanical system orientation and inspection at the equipment placement completion stage.
20. Update drawings to as-built condition as the project progresses and review with the CA.
21. Gather O & M data on all equipment, and assemble in binders as required by the commissioning specification. Submit to CA prior to the completion of construction.
22. Participate in training sessions, and schedule vendors and contractors to train the O&M staff as scheduled by the CA.
23. Provide written notification to the Construction Manager and CA that the following work has been completed in accordance with the contract documents and the equipment, systems and sub-systems are operating as required.
  - HVAC equipment including all fans, air handling units, dehumidification units, ductwork, dampers, terminals and all Division 15 equipment.
  - Refrigeration equipment, pumping systems and heat rejection equipment.
  - Fire stopping in the fire rated construction, including fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.
  - Fire detection and smoke detection devices furnished under other divisions of this specification as they affect the operation of the HVAC systems.
  - That the building control system is functioning to control mechanical equipment and smoke control systems as specified.
  - That the system verification checks are complete and all check sheets have been completed and ready for FPT's.
24. Provide a complete set of as-built drawings and project specific O & M manuals to the CA.

### **3.4 COMMISSIONING RESPONSIBILITIES – TAB AGENCY**

With respect to HVAC commissioning, the TAB agency shall:

1. Include costs for HVAC commissioning requirements in the quoted price. Commissioning is considered as a "single pass", for which failed tests will be subject to additional compensation per section 3.2.

2. Attend commissioning meetings scheduled by the CA prior to, and during, on-site TAB work being done.
3. Submit proposed TAB procedures to the CA and ME for review and acceptance.
4. Submit specification for system condition and operability required to execute TAB activities.
5. Submit equipment and system conditions required to CA, GC and ME within 2 weeks of signing contract.
6. Attend the TAB planning meeting scheduled by the CA. Be prepared to discuss the procedures that shall be followed in testing, adjusting and balancing the HVAC system.
7. Check that all pre-requisites for the start of TAB services have been completed prior to initiating their field work.
8. Carry out TAB services in accordance with the project specifications and the procedures submitted and approved at the beginning of the construction phase.
9. At the completion of the TAB work, submit the final TAB report to the General Contractor, CA and ME.
10. Participate in verification of the TAB report by the CA for verification or diagnostic purposes. This will consist of repeating a sample (normally 10% to 20%) of the measurements contained in the TAB report as directed by the CA.
11. Participate in O & M personnel training sessions as scheduled by the CA.

### **3.5 COMMISSIONING RESPONSIBILITIES – ELECTRICAL (DIVISION 26) CONTRACTOR**

With respect to HVAC commissioning, the electrical contractor shall:

1. Include cost for HVAC commissioning requirements in the quoted price.
2. Review design with respect to providing power to the HVAC equipment;
  - Verify that proper hardware specifications exist for functional performance and sequence of operation required by specification.
  - Verify that proper safeties (including fire alarm) and interlocks are included in the design of electrical connections for HVAC equipment.
3. Attend commissioning meetings scheduled by the CA.
4. Schedule work so that required electrical installations are completed, and systems verification checks and Functional Performance Tests can be carried out on schedule.
5. Inspect, check and confirm in writing the proper installation, identification and performance of all electrical services provided. Sign off as complete the electrical portion of the system verification check sheets prior to the start of TAB and functional performance testing.
6. Provide electrical and fire alarm system technicians to assist during system verification and functional performance testing as required by the CA. Electrical component/system verifications to be conducted by qualified electrical technicians as per the commissioning requirements of applicable electrical specification sections for equipment/systems. Testing to be witnessed by CA and/or Electrical Engineer.
7. In conjunction with the mechanical contractor, demonstrate system performance to the CA including all modes of system operation (e.g. occupied, unoccupied, emergency, fire alarm) during the Functional Performance Tests (FPTs). In order to test the system under all operating modes, the contractor shall provide override controls to simulate conditions not present at the time of testing. If improper functionality, incomplete work, or other deficiencies affecting system performance are discovered, the FPTs will be stopped by

the CA. Those responsible for deficient or incomplete work will be responsible for costs in accordance with 3.2 in this Section.

**End of Section**

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**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 01 33 00 - Submittal Procedures.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CAN/CSA G40.20/G40.21-, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2            CAN/CSA-S16-, Limit States Design of Steel Structures.
  - .3            CAN/CSA-S136-, Cold Formed Steel Structural Members.
  - .4            CSA-S136.1-, Commentary on CSA Standard S136.
  - .5            CSA W47.1-, Certification of Companies for Fusion Welding of Steel Structures.
  - .6            CSA W48-, Filler Metals and Allied Materials for Metal Arc Welding.
  - .7            CSA W55.3-, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .8            CSA W59-, Welded Steel Construction (Metal Arc Welding).

**1.3                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.
- .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.

**1.4                SHOP DRAWINGS**

- .1            Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Erection drawings: indicate details and information necessary for assembly and erection purposes including.
- .3            Ensure Fabricator shop drawings showing designed assemblies, components and connections including all cuts, copes, holes, welds and fasteners are stamped and signed by qualified professional engineer licensed in the provinces of fabrication.

**1.5                QUALITY ASSURANCE**

- .1            Structural steel fabricator to be certified as a Division 1 or 2 Company under CSA W47.1 - "Certification of Companies for Fusion Welding of Steel Structures", or CSA Standard

W55.3 "Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings" or both, as applicable.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Structural steel: to CAN/CSA-G40.20/G40.21  
W Shapes: new material conforming to CAN/CSA-G40.21-M92, Grade 350W.  
C Shapes: new material conforming to CAN/CSA-G40.21-M92, Grade 300W.
- .2 Bolts, nuts and washers: to ASTM A325
- .3 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .4 Shop paint primer: to CISC/CPMA2 75 SSPC SP-6.

**2.2 FABRICATION**

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 CAN/CSA-S136 and in accordance with reviewed shop drawings.
- .2 Continuously seal members by continuous welds where indicated. Grind smooth.
- .3 Provide holes in top and bottom flanges where required.

**2.3 SHOP PAINTING**

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with specified CISC/CPM standard.
- .2 All members to be prepared by commercial blast cleaning to SSPC-SP-6.
- .3 Apply one coat of shop applied primer to all members to manufacturers recommendations.
- .4 Coating System:
  - .1 Primer: Zinc Rich Epoxy, Interzinc 52, Amercoat 68A, or approved equivalent.
  - .2 Base coat: High Build Epoxy, Intergard 345, Amercoat 370 or approved equivalent.
  - .3 Top coat: Aliphatic Polyurethane, Interthane 990, Amercoat 450 HS or approved equivalent.
  - .4 Surface preparation of all structural steel to be sandblast to SP-6.
  - .5 Apply primer coat to all structural steel to 3 mils DFT.
  - .6 Apply base coat to all structural steel to 5-6 mils DFT.
  - .7 Apply top coat to all structural steel to 2-3 mils DFT.
- .5 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .6 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

- .7 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

**Part 3 Execution**

**3.1 GENERAL**

- .1 Structural steel work: in accordance with CAN/CSA-S16 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.

**3.2 ERECTION**

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 CAN/CSA-S136 and in accordance with reviewed erection drawings.
- .2 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

**3.3 FIELD QUALITY CONTROL**

- .1 All materials and workmanship subject to inspection on behalf of the owner.

**3.4 TOLERANCES**

- .1 Tolerance of all other structural steel shall be maintained strictly in accordance with CAN/CSA-S16.1.

**3.5 FIELD PAINTING**

- .1 Touch up damaged surfaces and surfaces approved paint.

END OF SECTION

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**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 01 33 00 - Submittal Procedures.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CAN/CSA G40.20/G40.21-, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2            CAN/CSA-G164-, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3            CAN/CSA-S16-, Limit States Design of Steel Structures.
  - .4            CAN/CSA-S136-, Cold Formed Steel Structural Members.
  - .5            CSA-S136.1-, Commentary on CSA Standard S136.
  - .6            CSA W47.1-, Certification of Companies for Fusion Welding of Steel Structures.
  - .7            CSA W48-, Filler Metals and Allied Materials for Metal Arc Welding.
  - .8            CSA W55.3-, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .9            CSA W59-, Welded Steel Construction (Metal Arc Welding).

**1.3                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.

**1.4                SHOP DRAWINGS**

- .1            Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Erection drawings: indicate details and information necessary for assembly and erection purposes including.
- .3            Ensure Fabricator shop drawings showing designed assemblies, components and connections including all cuts, copes, holes, welds and fasteners are stamped and signed by qualified professional engineer licensed in the provinces of fabrication.



## 1.5 QUALITY ASSURANCE

- .1 Structural steel fabricator to be certified as a Division 1 or 2 Company under CSA W47.1 - "Certification of Companies for Fusion Welding of Steel Structures", or CSA Standard W55.3 "Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings" or both, as applicable.

## Part 2 Products

### MATERIALS

- .1 Structural steel: to CAN/CSA-G40.20/G40.21  
W Shapes: new material conforming to CAN/CSA-G40.21-M92, Grade 350W.  
C Shapes: new material conforming to CAN/CSA-G40.21-M92, Grade 300W.
- .2 Bolts, nuts and washers: to ASTM A325
- .3 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .4 Shop paint primer: to CISC/CPMA2 75 SSPC SP-6 for exposed conditions.  
CISC/CPMA1 73A for all other locations

## 2.2 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 CAN/CSA-S136 and in accordance with reviewed shop drawings.
- .2 Continuously seal members by continuous welds where indicated. Grind smooth.
- .3 Provide holes in top and bottom flanges where required.

## 2.3 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with specified CISC/CPM standard.
- .2 All partially exposed members to be prepared by commercial blast cleaning to SSPC-SP-6.
- .3 Apply one coat of shop applied primer to all members to manufacturers recommendations.
- .4 Coating System for partially exposed members:
  - .1 Primer: Zinc Rich Epoxy, Interzinc 52, Amercoat 68A, or approved equivalent.
  - .2 Base coat: High Build Epoxy, Intergard 345, Amercoat 370 or approved equivalent.
  - .3 Top coat: Aliphatic Polyurethane, Interthane 990, Amercoat 450 HS or approved equivalent.
  - .4 Surface preparation of all structural steel to be sandblast to SP-6.
  - .5 Apply primer coat to all structural steel to 3 mils DFT.
  - .6 Apply base coat to all structural steel to 5-6 mils DFT.
  - .7 Apply top coat to all structural steel to 2-3 mils DFT.

- .5 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .6 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .7 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

**Part 3 Execution**

**3.1 GENERAL**

- .1 Structural steel work: in accordance with CAN/CSA-S16 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.

**3.2 ERECTION**

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 CAN/CSA-S136 and in accordance with reviewed erection drawings.
- .2 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

**3.3 FIELD QUALITY CONTROL**

- .1 All materials and workmanship subject to inspection on behalf of the owner.

**3.4 TOLERANCES**

- .1 Tolerance of all other structural steel shall be maintained strictly in accordance with CAN/CSA-S16.1.

**3.5 FIELD PAINTING**

- .1 Touch up damaged surfaces and surfaces approved paint.

END OF SECTION

**PART 1        General**

**1.1            RELATED SECTIONS**

- .1        Section 01 33 00 – Submittal Procedures
- .2        Section 05 12 23 – Structural Steel

**1.2            REFERENCE STANDARDS**

- .1        CSA Standard CAN/CSA-S136-"Cold Formed Steel Structural Members".
- .2        ASTM A 1003/A 1003M "Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members"
- .3        American Iron and Steel Institute's "North American Specifications for the Design of Cold-Formed Steel Structural Members"

**1.3            DESIGN REQUIREMENTS**

- .1        Design connections from cold formed metal joists to structural steel as required to resist loads shown on the drawings.
- .2        Design all blocking, tracks and accessories to ensure stability and complete installation.

**1.4            SHOP DRAWINGS**

- .1        Submit shop drawings in accordance with 01 33 00 - Submittal Procedures.
- .2        Clearly indicate sizes, spacing and locations of members, connections, attachments, anchorages, and size and type of fasteners.
- .3        Consultant's review of shop drawings will not relieve Contractor of responsibility for general and detail dimensions and fit, or any errors or omissions.

**1.5            QUALITY ASSURANCE**

- .1        AISI Specifications and Standards: Comply with AISI's "North American Specifications for the Design of Cold-Formed Steel Structural Members" and "Standard for Cold Formed Steel Framing – General Provisions."
  - .2        Design to strictly adhere to all codes and Reference Standards.
  - .3        In the event of conflict between pertinent codes, standards and/or regulations, most stringent shall govern.
  - .4        Preparation of shop drawings, design calculations and other structural data by a qualified professional engineer.
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## **1.6 INSPECTION AND TESTING**

- .1 Materials and workmanship subject to inspection on behalf of Owner.
- .2 Report failures of material to fit together properly to the Professional Engineer responsible for design of the joists and the Consultant. No corrective measures permitted unless approved by Professional Engineer responsible for design of joists and Consultant in writing.

## **PART 2 Products**

### **2.1 MATERIALS**

- .1 Subject to compliance with requirements, provide cold-formed metal framing product Mega-Joist featuring large extruded holes manufactured by Steelform or approved equivalent. Depth as indicated on the drawings with minimum 1.62" flange width and 12 gauge thickness.
- .2 Fabricate joists from steel sheet, structural quality, CAN/CSA-S136, metallic coated.
  - .1 Grade as required for structural performance.
  - .2 Coating to be Z275(G90).
- .3 Steel Joist Rim Track: Manufacturer's standard U-shaped steel joist track, punched with clip angles at required joist spacing, of web depths indicated; with stiffened webs and as follows:
  - .1 Minimum Base-Metal Thickness to match steel joists.

### **2.2 RELATED ACCESSORIES**

- .1 Fabricate steel-framing accessories from steel sheet, structural quality, to ASTM A 1003/A 1003M and CAN/CSA-S136, metallic coated, of same grade and coating used for framing members.
- .2 Provide accessories, as required, of manufacturer's standard thickness and configuration as follows:
  - .1 Supplementary framing
  - .2 Bridging and solid blocking
  - .3 Anchor clips
  - .4 Joist Hangers
  - .5 Hole Reinforcing Plates
  - .6 Web Stiffeners

### **2.3 ANCHORS AND FASTENERS**

- .1 Fasten joists to track using corrosion-resistant-coated, self-drilling, self-tapping steel drill screws that meet ASTM C 1513 and the manufacturers recommendations.
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- .2 Fasten joist track to structural steel beams using fasteners as detailed on approved shop drawings.

## **2.4 FABRICATION**

- .1 Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
- .2 Fabricate framing assemblies using jigs or templates.
- .3 Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
  - .1 Spacing: Space individual framing members no more than plus or minus 3mm (1/8 inch) from plan location.
  - .2 Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 3mm (1/8 inch).

## **PART 3 Execution**

### **3.1 INSTALLATION**

- .1 Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
  - .2 Install cold-formed framing and securely anchor to supporting structure as shown in shop drawings.
  - .3 Cut framing members by sawing or shearing; do not torch cut.
  - .4 Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
  - .5 Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
  - .6 Install framing members in one-piece lengths unless splice connections are indicated for track members.
  - .7 Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
  - .8 Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 3mm in 3.0m (1:1000) and as follows:
-

- .1 Space individual framing members no more than plus or minus 3mm (1/8 inch) from plan location.
- .9 Install perimeter track sized to match joists unless approved design is more stringent. Align and securely anchor to fasten track to supporting structure as corners, ends and spacing indicated on the shop drawings.
- .10 Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
  - .1 Install joists over supporting frame with a minimum end bearing of 38mm (1-1/2 inches).
  - .2 Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- .11 Install bridging at intervals indicated on the shop drawings. Fasten bridging at each joist intersection as follows:
  - .1 Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
  - .2 Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- .12 Secure joists to to prevent lateral movement of bottom flange.
- .13 Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

END OF SECTION 05 42 00

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**PART 1      General**

**1.1            RELATED SECTIONS**

- .1      Section 01 33 00 – Submittal Procedures
- .2      Section 05 12 23 – Structural Steel

**1.2            REFERENCE STANDARDS**

- .1      CSA Standard CAN/CSA-S136-"Cold Formed Steel Structural Members".
- .2      ASTM A 1003/A 1003M "Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members"
- .3      American Iron and Steel Institute's "North American Specifications for the Design of Cold-Formed Steel Structural Members"

**1.3            DESIGN REQUIREMENTS**

- .1      Design connections from cold formed metal joists to structural steel as required to resist loads shown on the drawings.
- .2      Design all blocking, tracks and accessories to ensure stability and complete installation.

**1.4            SHOP DRAWINGS**

- .1      Submit shop drawings in accordance with 01 33 00 - Submittal Procedures.
- .2      Clearly indicate sizes, spacing and locations of members, connections, attachments, anchorages, and size and type of fasteners.
- .3      Consultant's review of shop drawings will not relieve Contractor of responsibility for general and detail dimensions and fit, or any errors or omissions.

**1.5            QUALITY ASSURANCE**

- .1      AISI Specifications and Standards: Comply with AISI's "North American Specifications for the Design of Cold-Formed Steel Structural Members" and "Standard for Cold Formed Steel Framing – General Provisions."
- .2      Design to strictly adhere to all codes and Reference Standards.
- .3      In the event of conflict between pertinent codes, standards and/or regulations, most stringent shall govern.
- .4      Preparation of shop drawings, design calculations and other structural data by a qualified professional engineer.

**1.6            INSPECTION AND TESTING**

- .1 Materials and workmanship subject to inspection on behalf of Owner.
- .2 Report failures of material to fit together properly to the Professional Engineer responsible for design of the joists and the Consultant. No corrective measures permitted unless approved by Professional Engineer responsible for design of joists and Consultant in writing.

## **PART 2 Products**

### **2.1 MATERIALS**

- .1 Subject to compliance with requirements, provide cold-formed metal framing product Mega-Joist featuring large extruded holes manufactured by Steelform or approved equivalent. Depth, section type, flange width and thickness as indicated on drawings.
- .2 Fabricate joists from steel sheet, structural quality, CAN/CSA-S136, metallic coated.
  - .1 Grade as required for structural performance.
  - .2 Coating to be Z275(G90).
- .3 Steel Joist Rim Track: Manufacturer's standard U-shaped steel joist track, punched with clip angles at required joist spacing, of web depths indicated; with stiffened webs and as follows:
  - .1 Minimum Base-Metal Thickness to match steel joists.

### **2.2 RELATED ACCESSORIES**

- .1 Fabricate steel-framing accessories from steel sheet, structural quality, to ASTM A 1003/A 1003M and CAN/CSA-S136, metallic coated, of same grade and coating used for framing members.
- .2 Provide accessories, as required, of manufacturer's standard thickness and configuration as follows:
  - .1 Supplementary framing
  - .2 Bridging and solid blocking
  - .3 Anchor clips
  - .4 Joist Hangers
  - .5 Hole Reinforcing Plates
  - .6 Web Stiffeners

### **2.3 ANCHORS AND FASTENERS**

- .1 Fasten joists to track using corrosion-resistant-coated, self-drilling, self-tapping steel drill screws that meet ASTM C 1513 and the manufacturers recommendations.
- .2 Fasten joist track to structural steel beams using fasteners as detailed on approved shop drawings.

### **2.4 FABRICATION**

- .1 Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and



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with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

- .2 Fabricate framing assemblies using jigs or templates.
- .3 Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
  - .1 Spacing: Space individual framing members no more than plus or minus 3mm (1/8 inch) from plan location.
  - .2 Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 3mm (1/8 inch).

### **PART 3 Execution**

#### **3.1 INSTALLATION**

- .1 Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- .2 Install cold-formed framing and securely anchor to supporting structure as shown in shop drawings.
- .3 Cut framing members by sawing or shearing; do not torch cut.
- .4 Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
- .5 Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- .6 Install framing members in one-piece lengths unless splice connections are indicated for track members.
- .7 Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- .8 Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 3mm in 3.0m (1:1000) and as follows:
  - .1 Space individual framing members no more than plus or minus 3mm (1/8 inch) from plan location.
- .9 Install perimeter track sized to match joists unless approved design is more stringent. Align and securely anchor to fasten track to supporting structure as corners, ends and spacing indicated on the shop drawings.
- .10 Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

- 
- .1 Install joists over supporting frame with a minimum end bearing of 38mm (1-1/2 inches).
  - .2 Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
  - .11 Install bridging at intervals indicated on the shop drawings. Fasten bridging at each joist intersection as follows:
    - .1 Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
    - .2 Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
  - .12 Secure joists to prevent lateral movement of bottom flange.
  - .13 Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

END OF SECTION 05420

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**PART 1      General**

**1.1          REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM A53/A53M-[99b], Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A269-[98], Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .3 ASTM A307-[97], Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.40-[97], Anti-corrosive Structural Steel Alkyd Primer.
  - .2 CAN/CGSB-1.108-[M89], Bituminous Solvent Type Paint.
  - .3 CAN/CGSB-1.181-[92], Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA)
  - .1 CAN/CSA-G40.20/G40.21-[98], General Requirements for Rolled or Welded Structural Quality Steel.
  - .2 CAN/CSA-G164-[M92(R1998)], Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-S16.1-[94], Limit States Design of Steel Structures.
  - .4 CSA W48.1-[M1991(R1998)], Carbon Steel Covered Electrodes for Shielded Metal Arc Welding.
  - .5 CSA W48.2-[M1992(R1998)], Chromium-Nickel Steel Covered Electrodes for Shielded.
  - .6 CSA W48.3-[M1993(R1998)], Low Alloy Steel Covered Electrodes for Shielded Metal Arc Welding.
  - .7 CSA W48.4-[95], Solid Carbon Steel Filler Metals for Gas Shielded Arc Welding.
  - .8 CSA W48.5-[M1990(R1996)], Carbon Steel Electrodes for Flux- and Metal-Cored Arc Welding.
  - .9 CSA W48.6-[96], Fluxes and Carbon Steel Electrodes for Submerged Arc Welding.
  - .10 CSA W59-[M1998], Welded Steel Construction (Metal Arc Welding).

**1.2          SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

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**1.3 PROTECTION**

- .1 Deliver, store, handle and protect materials in accordance with Section 016100 - Common Product Requirements.
- .2 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
- .3 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

**PART 2 Products**

**2.1 MATERIALS**

- .1 Steel sections, angles and plates: to CAN/CSA-G40.20/G40.21, Grade 300W.
- .2 Hollow Structural Sections: new material conforming to CAN/CSA – G40.21, Grade 350W, Class C.
- .3 Steel pipe: to ASTM A53/A53M standard weight, black finish.
- .4 Welding materials: to CSA W59.
- .5 Welding electrodes: to CSA W48 Series.
- .6 Bolts and anchorbolts: to ASTM A307.
- .7 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

**2.2 FABRICATION**

- .1 The fabricator and erector are to be a certified company to CSA W47.1 and all welding work is to be performed by CWB certified welders.
- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .3 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.
- .4 Where possible, fit and shop assemble work, ready for erection.
- .5 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

**2.3 FINISHES**

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m<sup>2</sup> to CAN/CSA-G164.
- .2 Shop coat primer: to CAN/CGSB-1.40.
- .3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

- .4 Bituminous paint: to CAN/CGSB-1.108.

## **2.4 ISOLATION COATING**

- .1 Isolate aluminum from following components, by means of bituminous paint:
- .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
  - .2 Concrete, mortar and masonry.
  - .3 Wood.

## **2.5 SHOP PAINTING**

- .1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, and grease. Do not paint when temperature is lower than 7°C.
- .3 Clean surfaces to be field welded; do not paint.

## **2.6 CHANNEL FRAMES**

- .1 Fabricate frames from steel, sizes of channel and opening as indicated.
- .2 Weld channels together to form continuous frame for jambs and head of openings, sizes as indicated.
- .3 Finish: prime coat painted

## **PART 3 Execution**

### **3.1 ERECTION**

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Engineer such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CAN/CSA-S16.1, or weld.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

END OF SECTION

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**PART 1      General**

**1.1          REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI/NPA A208.1-[1999], Particleboard, Mat Formed Wood.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A653/A653M-[05a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
  - .2 ASTM C36/C36M-[03], Standard Specification for Gypsum Wallboard.
  - .3 ASTM C578-[05a], Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - .4 ASTM C1289-[05a], Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
  - .5 ASTM D1761-[88(2000)], Standard Test Methods for Mechanical Fasteners in Wood.
  - .6 ASTM D5055-[05], Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
  - .7 ASTM D5456-[05a], Standard Specification for Evaluation of Structural Composite Lumber Products.
- .3 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.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-11.3-[M87], Hardboard.
  - .2 CAN/CGSB-51.32-[M77], Sheathing, Membrane, Breather Type.
  - .3 CAN/CGSB-51.34-[M86], Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .4 CAN/CGSB-71.26-[M88], Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .5 Canadian Standards Association (CSA International)
  - .1 CSA A123.2-[03], Asphalt Coated Roofing Sheets.
  - .2 CAN/CSA-A247-[M86], Insulating Fiberboard.
  - .3 CSA B111-[1974(R2003)], Wire Nails, Spikes and Staples.
  - .4 CAN/CSA-G164-[M92(R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .5 CSA O112 Series-[M1977(R2006)], CSA Standards for Wood Adhesives.
  - .6 CSA O121-[M1978(R2003)], Douglas Fir Plywood.
  - .7 CSA O122-[06], Structural Glued-Laminated Timber.
  - .8 CSA O141-[05], Softwood Lumber.
  - .9 CSA O151-[04], Canadian Softwood Plywood.

- .10 CSA O153-[M1980(R2003)], Poplar Plywood.
- .11 CAN/CSA-O325.0-[92(R2003)], Construction Sheathing.
- .12 CSA O437 Series-[93(R2006)], Standards on OSB and Waferboard.
- .6 Forest Stewardship Council (FSC)
  - .1 FSC-STD-01-001-[2004], FSC Principle and Criteria for Forest Stewardship.
  - .2 FSC-STD-20-002-[2004], Structure and Content of Forest Stewardship Standards V2-1
  - .3 FSC Accredited Certified Bodies.
- .7 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber [2005].
- .8 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1113-[04], Architectural Coatings.
  - .2 SCAQMD Rule 1168-[05], Adhesives and Sealants Applications.
- .9 Truss Design and Procedures for Light Metal Connected Wood Trusses, Truss Plate Institute of Canada.
- .10 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S706-[97], Mineral Fibre Thermal Insulation for Buildings.

## **1.2 SUBMITTALS**

- .1 Submit Submittal submissions: in accordance with Section 01 33 00 - Submittal Procedures
- .2 Sustainable Submittals:
  - .1 Co-ordinate submittal requirements and provide submittals required by Section 01 47 13 - Sustainable Requirements

## **1.3 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA standards.
- .3 Sustainable Requirements:
  - .1 Construction requirements: in accordance with Section 01 47 13 - Sustainable Requirements

## **1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials.
- .2 Set aside damaged wood and dimensional lumber off-cuts for approved alternative uses (e.g. bracing, blocking, cripples, bridging). Store this separated reusable wood waste convenient to cutting station and area of work.



- .3 Separate metal, plastic, wood and corrugated cardboard-packaging in accordance with the Waste Management Plan and place in designated areas for recycling.
- .4 Do not burn scrap at the project site.
- .5 Fold up metal banding, flatten, and place in designated area for recycling.

## **PART 2 Products**

### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 13 - Sustainable Requirements

### **2.2 FRAMING AND STRUCTURAL MATERIALS**

- .1 Material and Resources Credit [MR - 7 Certified Wood] co-ordinate with Section 01 47 14 – Sustainable Product Requirements
- .2 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 Forestry Stewardship Council (FSC) certified.
- .3 Indoor Environmental Quality Credit [EQ - 4.4 Low - Emitting Materials: Composite Wood and Laminates Adhesives]. Co-ordinate with Section 01 35 21 - LEED Requirements.
  - .1 SCAQMD Rule 1168, Adhesives and Sealants Applications.
- .4 Glulam in accordance with Structural Glued-Laminated Timber CSA-O122.
  - .1 Forest Stewardship Council (FSC) certified.
- .5 Wood I-joists in accordance with Prefabricated Wood I-Joists ASTM D5055.
  - .1 Forest Stewardship Council (FSC) certified.
- .6 Light-frame trusses in accordance with "Truss Design and Procedures for Light Metal Connected Wood Trusses", Truss Plate Institute of Canada.
  - .1 Forest Stewardship Council (FSC) certified.
- .7 Structural Composite Lumber (SCL) in accordance with ASTM D5456.
  - .1 Forest Stewardship Council (FSC) certified.
- .8 Framing and board lumber: in accordance with NBC, except as follows:
  - .1 SPF species, NLGA Construction Light Framing grade.
  - .2 Forest Stewardship Council (FSC) certified.
- .9 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
  - .1 S2S is acceptable

- .2 Board sizes: "Standard" or better grade.
- .3 Dimension sizes: "Standard" light framing or better grade.
- .4 Post and timbers sizes: "Standard" or better grade.
- .5 Forest Stewardship Council (FSC) certified.

## 2.3 PANEL MATERIALS

- .1 Indoor Environmental Quality Credit [EQ - 4.4 Low - Emitting Materials: Composite Wood and Laminates Adhesives]. Co-ordinate with Section 01 47 14 – Sustainable Product Requirements
  - .1 SCAQMD Rule 1168, Adhesives and Sealants Applications.
- .2 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.0.
  - .1 Forest Stewardship Council (FSC) certified.
- .3 Douglas fir plywood (DFP): to CSA O121, standard construction.
  - .1 Forest Stewardship Council (FSC) certified.
- .4 Canadian softwood plywood (CSP): to CSA O151, standard construction.
  - .1 Forest Stewardship Council (FSC) certified.
- .5 Poplar plywood (PP): to CSA O153, standard construction.
  - .1 Forest Stewardship Council (FSC) certified.
- .6 Insulating fiberboard sheathing: to [CAN/CSA-A247] [CAN/ULC-S706].
- .7 Glass fibre board sheathing: non-structural, rigid, faced, fiberglass, insulating exterior sheathing board.
- .8 Expanded polystyrene sheathing: to ASTM C578.
- .9 Gypsum sheathing: to ASTM C36/C36M.

## 2.4 ACCESSORIES

- .1 Exterior wall sheathing paper: to CAN/CGSB-51.32 single ply type as indicated.
- .2 Polyethylene film: to CAN/CGSB-51.34, Type 1, 0.15 mm thick.
- .3 Sealants: Section 079210 – Joint Sealing.
- .4 Subflooring adhesive: to CGSB-71.26, cartridge loaded.
- .5 General purpose adhesive: to CSA O112 Series.
- .6 Nails, spikes and staples: to CSA B111.
  - .1 Galvanized for exterior locations;
  - .2 Plain finish for interior locations;
  - .3 Size and type to suit application.
- .7 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

- .1 Galvanized for exterior locations;
- .2 Plain finish for interior locations;
- .3 Size and type to suit application.
  
- .8 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
- .9 Joist hangers: minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.
- .10 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, sheet metal, formed to prevent dishing. Bell or cup shapes not acceptable.
- .11 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, type approved by Engineer.

## **2.5 WOOD PRESERVATIVE**

- .1 SCAQMD Rule #1113 - Architectural Coatings.
- .2 Maximum allowable VOC limit to be within specified LEED VOC limits

## **PART 3 Execution**

### **3.1 PREPARATION**

- .1 Store wood products.

### **3.2 INSTALLATION**

- .1 Comply with requirements of NBC 2005 Part 9 supplemented by following paragraphs.
- .2 Install members true to line, levels and elevations, square and plumb.
- .3 Construct continuous members from pieces of longest practical length.
- .4 Install spanning members with "crown-edge" up.
- .5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .6 Install wall sheathing in accordance with manufacturer's printed instructions.
- .7 Install roof sheathing in accordance with requirements of NBC.
- .8 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding electrical equipment mounting boards, and other work as required.
- .9 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.

- .1 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .10 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .11 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.
- .12 Install sleepers as indicated.
- .13 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

### **3.3 ERECTION**

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .2 Countersink bolts where necessary to provide clearance for other work.
- .3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

### **3.4 PRESSURE TREATED WOOD**

- .1 All wood blocking in contact with cementitious materials, or located on exterior side of air barrier or roof membrane, shall be "pressure treated".
- .2 Treat surfaces exposed by cutting, trimming, or boring with a liberal brush or dip application of preservative, compatible with pressure treatment, before installation.

### **3.5 SCHEDULES**

- .1 Roof and wall sheathing: indicated on plans
- .2 Electrical equipment mounting boards:
  - .1 Plywood, CSP grade, square edge 19 mm thick.

END OF SECTION

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**PART 1      General**

**1.1          REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI A208.1-[99], Particleboard.
  - .2 ANSI A208.2-[02], Medium Density Fibreboard (MDF).
  - .3 ANSI/HPVA HP-1-[2004], Standard for Hardwood and Decorative Plywood.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E1333-[96(2002)], Standard Test Method for Determining Formaldehyde Concentrations in Air and Emissions Rates from Wood Products Using a Large Chamber.
- .3 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1 Architectural Woodwork Quality Standards Illustrated, 8th edition, Version 1.0 [2003].
- .4 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.
- .5 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-11.3-[M87], Hardboard.
- .6 Canadian Plywood Association (CanPly)
  - .1 The Plywood Handbook [2005].
- .7 Canadian Standards Association (CSA International)
  - .1 CSA B111-[74(R2003)], Wire Nails, Spikes and Staples.
  - .2 CAN/CSA-G164-[M92(R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CSA O121-[M89(R2003)], Douglas Fir Plywood.
  - .4 CAN/CSA O141-[91(R1999)], Softwood Lumber.
  - .5 CSA O151-[04], Canadian Softwood Plywood.
  - .6 CSA O153-[M1980(R2003)], Poplar Plywood.
  - .7 CSA Z760-[94], Life Cycle Assessment.
- .8 Forest Stewardship Council (FSC)
  - .1 FSC-STD-01-001-[2004], FSC Principle and Criteria for Forest Stewardship.
- .9 National Hardwood Lumber Association (NHLA)
  - .1 Rules for the Measurement and Inspection of Hardwood and Cypress [1998].
- .10 National Lumber Grades Authority (NLGA)

- .1 Standard Grading Rules for Canadian Lumber [2005].
- .11 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1113-[04], Architectural Coatings.
  - .2 SCAQMD Rule 1168-[05], Adhesives and Sealants Applications.
- .12 Underwriters Laboratories of Canada (ULC)
  - .1 CAN4-S104-[80(R1985)], Standard Method for Fire Tests of Door Assemblies.
  - .2 CAN4-S105-[85(R1992)], Standard Specification for Fire Door Frames, meeting the Performance Required by CAN4-S104.

## **1.2 SUBMITTALS**

- .1 Submit Submittal submissions: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Submittals:
  - .1 Co-ordinate submittal requirements and provide submittals required by Section 01 47 13 - Sustainable Requirements
- .3 Shop Drawings Submittals: in accordance with Section 01 33 00 - Submittal Procedures
  - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
  - .2 Indicate materials, thicknesses, finishes and hardware.

## **1.3 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.
- .3 Wood materials certified by Forestry Stewardship Council, in compliance with LEED Credit MR 7.
- .4 Provide Forestry Stewardship Council Chain of Custody certificates for wood materials in compliance with LEED Credit MR 7.
- .5 Sustainable Requirements:
  - .1 Construction requirements: in accordance with Section 01 47 15 - Sustainable Requirements: Construction
  - .2 Verification: contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification
  - .3 Wood fire rated frames and panels: listed and labeled by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 and CAN4-S105 for ratings specified or indicated.

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## **1.4 REGULATORY REQUIREMENTS**

- .1 Wood fire rated frames and panels: listed and labelled by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 and CAN4-S105 for ratings specified or indicated.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, handle, store and protect materials in accordance with Section 016100 – Common Product Requirements.
  - .1 Protect materials against dampness during and after delivery.
  - .2 Store materials in ventilated areas, protected from extreme changes of temperature or humidity.
- .2 Protect materials against dampness during and after delivery.
- .3 Store materials in ventilated areas, protected from extreme changes of temperature or humidity.

## **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal and Waste Reduction Workplan, and Waste Management plan to maximum extent economically possible.
- .2 Separate wood waste in accordance with Waste Management Plan and place in designated areas in categories as follows for recycling: Solid wood/softwood/hardwood, composite wood, treated, painted, or contaminated wood.
- .3 Separate metal, plastic, wood and corrugated cardboard-packaging in accordance with the Waste Management Plan and place in designated areas for recycling.
- .4 Do not burn scrap at the project site.
- .5 Fold up metal banding, flatten, and place in designated area for recycling.

## **PART 2 Products**

### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 13 - Sustainable Requirement.

### **2.2 LUMBER MATERIAL**

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 6 % or less in accordance with following standards:
  - .1 CAN/CSA-O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 AWMAC Premium grade, moisture content as specified.
  - .4 Forest Stewardship Council (FSC) certified.

- .2 Machine stress-rated lumber is acceptable.
- .3 Hardwood lumber: moisture content 6 % or less in accordance with following standards:
  - .1 AWMAC Premium grade, moisture content as specified.
  - .2 Select or better, plain sawn. Species per Section 090600 – Schedule for Finishes.
  - .3 Forest Stewardship Council (FSC) certified.

## **2.3 ACCESSORIES**

- .1 Nails and staples: to CSA B111; galvanized to CAN/CSA-G164 for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.
- .2 Wood screws: plain, type and size to suit application.
- .3 Splines: wood.
- .4 Adhesive: recommended by manufacturer.
- .5 Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this section. Maximum VOC limit as specified in LEED section.

## **PART 3 Execution**

### **3.1 INSTALLATION**

- .1 Do finish carpentry to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.
- .2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .3 Form joints to conceal shrinkage.

### **3.2 CONSTRUCTION**

- .1 Fastening.
  - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
  - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
  - .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.
  - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .2 Standing and running trim.
  - .1 Butt and cope internal joints of trim to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.



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- .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
  - .3 Install window trim in single lengths without splicing.

### 3.3 SCHEDULES

- .1 Standing and running trim.
  - .1 Interior:
    - .1 Grade: Select or better, plain sawn.
    - .2 Solid stock: Species per Section 090600 – Schedule for Finishes.

END OF SECTION

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**PART 1      General**

**1.1          REFERENCES**

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1 Architectural Woodwork Quality Standards Illustrated, 8th edition, Version 1.0 (2005).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN3-A172-[M79], High Pressure, Paper Base, Decorative Laminates.
  - .2 CAN/CGSB-71.20-[M88], Adhesive, Contact, Brushable.
- .3 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.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA B111-[74(R2003)], Wire Nails, Spikes and Staples.
  - .2 CSA O112.4 Series-[M1977(R2006)], Standards for Wood Adhesives.
  - .3 CSA O112.5-Series-M-[1977(R2006)], Urea Resin Adhesives for Wood (Room- and High-Temperature Curing).
  - .4 CSA O112.7-Series M-[1977(R2006)], Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing).
  - .5 CSA O121-[M89(R2003)], Douglas Fir Plywood.
  - .6 CSA O141-[05], Softwood Lumber.
  - .7 CSA O151-[04], Canadian Softwood Plywood.
  - .8 CSA O153-[M1980(R2003)], Poplar Plywood.
- .5 International Organization for Standardization (ISO)
  - .1 ISO 14040-[2006], Environmental Management-Life Cycle Assessment - Principles and Framework.
  - .2 ISO 14041-[98], Environmental Management-Life Cycle Assessment - Goal and Scope Definition and Inventory Analysis.
- .6 Forest Stewardship Council (FSC)
  - .1 FSC Accredited Certified Bodies.
- .7 National Electrical Manufacturers Association (NEMA)
  - .1 ANSI/NEMA LD-3-[05], High-Pressure Decorative Laminates.
- .8 National Hardwood Lumber Association (NHLA)
  - .1 Rules for the Measurement and Inspection of Hardwood and Cypress [1998].
- .9 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber [2005].

- .10 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1113-[04], Architectural Coatings.
  - .2 SCAQMD Rule 1168-[05], Adhesives and Sealants Applications.

## **1.2 SUBMITTALS**

- .1 Provide Submittal submissions: in accordance with Section 01 33 00 - Submittal Procedures
- .2 Sustainable Submittals:
  - .1 Co-ordinate submittal requirements and provide submittals required by Section 01 47 13 - Sustainable Requirements
- .3 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures
  - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
  - .2 Indicate materials, thicknesses, finishes and hardware.
  - .3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

## **1.3 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.
- .3 Sustainable Requirements:
  - .1 Construction requirements: in accordance with Section 01 47 13 - Sustainable Requirements

## **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, handle, store and protect materials of this section in accordance with Section 016100 - Common Product Requirements.
- .2 Protect millwork against dampness and damage during and after delivery.
- .3 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

## **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal
- .2 Do not burn scrap at the project site.

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**PART 2      Products**

**2.1            SUSTAINABLE REQUIREMENTS**

- .1      Materials and products in accordance with Section 01 47 13 - Sustainable Requirements

**2.2            MATERIALS**

- .1      Material and Resources Credit [MR - 7 Certified Wood] co-ordinate with Section 01 47 14 – Sustainable Product Requirements
- .2      Indoor Environmental Quality Credit [EQ - 4.4 Low - Emitting Materials: Composite Wood and Laminates Adhesives] Co-ordinate with Section 01 47 14 – Sustainable Product Requirements and Section 01 47 18 – Indoor Air Quality
- .3      Softwood lumber: unless specified otherwise, S4S, moisture content 19 % or less in accordance with following standards:
  - .1      CSA O141.
  - .2      NLGA Standard Grading Rules for Canadian Lumber.
  - .3      AWMAC premium grade, moisture content as specified.
  - .4      Forestry Stewardship Council (FSC) certified.
- .4      Machine stress-rated lumber is acceptable for all purposes.
- .5      Hardwood lumber: moisture content 6 % or less in accordance with following standards:
  - .1      National Hardwood Lumber Association (NHLA).
  - .2      AWMAC premium grade, moisture content as specified.
  - .3      Forestry Stewardship Council (FSC) certified.
- .6      Douglas fir plywood (DFP): to CSA O121, standard construction.
  - .1      Forestry Stewardship Council (FSC) certified.
  - .2      Urea-formaldehyde free.
- .7      Canadian softwood plywood (CSP): to CSA O151, standard construction.
  - .1      Forestry Stewardship Council (FSC) certified.
  - .2      Urea-formaldehyde free.
- .8      Hardwood plywood: to CSA O115.
  - .1      Flat cut B face, 1 back, combination core as per “Armorcore”. Grain installed vertical.
  - .2      Species as per Section 090600 – Schedule for Finishes.
  - .3      Forestry Stewardship Council (FSC) certified.
  - .4      Urea-formaldehyde free.
- .9      ParticleBoard: to CAN3-0188.1, Grade R, thickness 19 mm unless otherwise indicated, minimum density 720 kg/m<sup>2</sup>, with high waterproof resin binders of grade to suit application, sanded faces.
  - .1      Forestry Stewardship Council (FSC) certified.
  - .2      Urea-formaldehyde free.

- .10 Pre-finished Hardboard: to CAN/CGSB-11.3 , Be manufactured such that formaldehyde emissions do not exceed [0.15] ppm ([180] g/m ) when tested in accordance with ASTM E1333.
  - .1 Forestry Stewardship Council (FSC) certified.
  - .2 Urea-formaldehyde free.
- .11 MDF (medium density fibreboard) core: to ANSI A208.2, Grade R, thickness 19 mm unless otherwise indicated, density 769 kg/m<sup>2</sup>.
  - .1 Medium density fibreboard must:
    - .1 Meet the performance requirements of ANSI A208.2.
    - .2 Be manufactured such that formaldehyde emissions do not exceed [0.15] ppm ([180] g/m ) when tested in accordance with ASTM E1333.
    - .3 Contain at least [15] % recycled materials by weight.
  - .2 Forestry Stewardship Council (FSC) certified.
  - .3 Urea-formaldehyde free.
- .12 Thermofused Melamine (MCP): minimum 146 g/m<sup>2</sup> paper fused to wood particleboard, to NEMA LD3 Grade VGL
  - .1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).
- .13 Nails and staples: to CSA B111.
- .14 PVC Edge:
  - .1 3 mm hot-melt adhesive applied
  - .2 All edges and corners to be routed to 2 or 2.5 mm radius.
  - .3 Colour: see Section 090600 – Schedule for Finishes.
- .15 Wood screws: stainless steel, type and size to suit application.
- .16 Splines: wood.
- .17 Laminated plastic for flatwork: to CAN3-A172, Grade GP, based on printed pattern as shown on colour board selected from manufacturer's standard colour range with satin finish
  - .1 Horizontal Surfaces: Type HD, 1.2 mm thick;.
  - .2 Vertical Surfaces: Type LD, 0.7 mm thick;.
- .18 Laminated plastic backing sheet: Grade BK, Type LD not less than 0.5 mm thick or same thickness and colour as face laminate.
- .19 Sealant: Section 079210 - Joint Sealing.

## **2.3 CABINET HARDWARE**

- .1 Use one manufacturer's product for all similar items.
- .2 Cabinet hardware: to CAN/CGSB-69.25, as listed below.

- .1 Hinges: Concealed self-closing 180 degree hinges. 2 parts: arm and bowl. Riveted axle. Texted to greater than 100,000 opening cycles with no door sag. As per Hetal MB series hinges. Number of hinges shall be based on height of door (door maximum width 585 mm)

Door Height	number of Hinges Per Door
0 - 890 mm	2
890 - 1600 mm	3
1600 - 1980 mm	4
1980 - 2400 mm	5

- .2 Pulls: back mounted pull, 6 mm diameter x 100 mm "D-handle" pull, projecting 38 mm, satin aluminum finish.
- .3 Shelf rests: shelf rest installed in holes drilled.
- .4 Shelf brackets and standards: vertical slotted shelf standard, with shelf brackets, finished to 626.
- .5 Drawer slides: full extension side mounted drawer slides. Dynamic load capacity of 45 kg..

.3 Cabinet locks: to CAN/CGSB-69.27

- .1 Door or drawer locks: Best Lock corporation SL Series Deadbolt, 626 Finish, 3L7RD2626
- .2 Cylinders: key into keying system as directed.

**2.4 MISCELLANEOUS HARDWARE**

- .1 Auxiliary hardware: to CAN/CGSB-69.32, [as listed below], finished to 626.
- .1 Garment rods: minimum 25 mm dia x 1.2 mm wall thickness chrome plated steel tubing of required length, rod material and anchorage to withstand minimum downward pull of 1.2 kN.
- .2 Strap and tee hinges and hasps: to CAN/CGSB-69.36, designated by letter A and numeral identifiers listed in Hardware Schedule, size [in accordance with table I], finished to 626.
- .3 Heavy duty support with brace for shelf and closet rod, wrought steel, enamel paint finish, colour by Engineer.
- .4 Grommets:
- .1 60 mm diameter cable grommet in colours as selected by Engineer.

**2.5 MANUFACTURED UNITS**

- .1 Casework.
- .1 Fabricate caseworks to AWMAC premium quality grade.
- .2 Furring, blocking, nailing strips, grounds and rough bucks and sleepers.
- .1 Board sizes: "Standard" or better grade.
- .2 Dimension sizes: "Standard" light framing or better grade.
- .3 Forestry Stewardship Council (FSC) certified.
- .4 Urea-formaldehyde free.

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- .3 Bases:
    - .1 All units shall have a 19 mm plywood level base 100 mm high.
  - .4 Case bodies
    - .1 19 mm MCP U.N.O.
    - .2 Finished ends to be rebated to accept back. All joints to be dowelled and glued for a secure fit.
    - .3 Provide edge banding as indicated on drawings, colour to match exposed faces.
    - .4 Drill gables at 32 mm on centre for architectural woodwork hardware.
  - .5 Backs.
    - .1 Cabinet back to be 13 MCP U.N.O.. Colour to match cabinet interior.
  - .6 Shelving.
    - .1 19 mm thick, MCP U.N.O. All edges to be banded with PVC edging U.N.O.
    - .2 Shelves over 760 mm in length shall be 25 mm thick MCP. All edges to be banded with PVC edging U.N.O.
    - .3 All shelves, fixed and adjustable, shall be of adequate thickness with reinforcing and/or additional shelf supports to limit deflection of shelves to 1/360 when subject to a uniform load of 320 kg/m<sup>2</sup>.
  - .2 Drawers
    - .1 Fabricate drawers to AWMAC premium grade supplemented as follows:
    - .2 Sides and Backs.
      - .1 Sides, back and sub-front shall be 13 mm MCP. Back and sub-front shall be dowelled and glued into the sides. Edge taped.
    - .3 Bottoms.
      - .1 Drawer bottom shall be 13 mm thick MCP U.N.O., dadoed into sub-front, sides and back. U.N.O.
    - .4 Drawer Faces
      - .1 19 mm thick, MCP U.N.O.
      - .2 Where indicated, hardwood plywood, 19 mm thick, complete with hardwood edges 3 mm thick.
      - .3 Provide 3 mm PVC edge, to all edges of all MCP drawer fronts U.N.O.
  - .3 Casework Doors
    - .1 Fabricate doors to AWMAC premium grade supplemented as follows:
    - .2 Particleboard, 19 mm thick, laminated with plastic laminate on exposed surface and interior surface.
    - .3 Hardwood plywood, 19 mm thick, complete with hardwood veneer edges.
    - .4 Double doors shall be used on all cabinets in excess of 500 mm in width.
    - .5 Provide 3 mm PVC edge, to all edges of all doors and drawer fronts.
  - .4 Change Benches
    - .1 Fabricate bench to AWMAC premium grade supplemented as follows:
      - .1 Solid wood as per details.

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## **2.6 FABRICATION**

- .1 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.
- .2 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .3 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .4 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .6 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .7 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .8 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.
- .9 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- .10 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .11 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .12 Apply laminated plastic liner sheet where indicated.

## **PART 3 Execution**

### **3.1 INSTALLATION**

- .1 Do architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.
- .2 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.
- .3 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted cabinets.
- .4 Use draw bolts in countertop joints.



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- .5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
  - .6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant.
  - .7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.
  - .8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.
  - .9 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where approved. Slightly bevel arises.
  - .10 For site application, offset joints in plastic laminate facing from joints in core.

### **3.2 CLEANING**

- .1 Clean millwork and cabinet work inside cupboards and drawers and outside surfaces.
- .2 Remove excess glue from surfaces.

### **3.3 PROTECTION**

- .1 Protect millwork and cabinet work from damage until final inspection.

END OF SECTION

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**PART 1      General**

**1.1            REFERENCES**

- .1      Underwriters Laboratories of Canada (ULC)
  - .1          CAN/ULC - S702 - [97], Thermal Insulation, Mineral Fibre, for Buildings.
- .2      American Society for Testing and Materials (ASTM)
  - .1          ASTM C 1320-[99], Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

**PART 2      Products**

**2.1            INSULATION**

- .1      Batt and blanket mineral fibre: to CAN/ULC - S702 - [97], Type 1, thickness and thermal resistance as indicated.
- .2      Minimum recycled content of 60%

**2.2            ACCESSORIES**

- .1      Insulation clips:
  - .1          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      Staples: 12 mm minimum leg.

**PART 3      Execution**

**3.1            INSULATION INSTALLATION**

- .1      Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2      Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .3      Do not compress insulation to fit into spaces.
- .4      Do not enclose insulation until it has been inspected and approved by Engineer.

END OF SECTION

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**Part 1            General**

**1.1                REFERENCES**

- .1     Underwriters' Laboratories of Canada (ULC)
  - .1     CAN/ULC-S101-1989, Fire Endurance Tests of Building Construction and Materials.
  - .2     CAN/ULC-S102-1988(R2000), Surface Burning Characteristics of Building Materials and Assemblies.
  - .3     CAN/ULC-S705.1-01, Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Material Specification.
  - .4     CAN/ULC-S705.2-02, Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Installer's Responsibilities-Specification.

**1.2                SUBMITTALS**

- .1     Submit test reports, verifying qualities of insulation meet or exceed requirements of this specification, in accordance with Section 01 45 00 - Quality Control.
- .2     Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
- .3     Product Data: Provide data on materials, describing insulation properties, and surface burning characteristics.
- .4     LEED Information: Indicate percentage of waste materials by weight diverted from landfill and recycled.
- .5     Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special treatment.
- .6     Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

**1.3                QUALITY ASSURANCE**

- .1     Applicators to conform to CUFCA Quality Assurance Program.
- .2     Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three (3) years documented experience.
- .3     Applicator: Company specializing in performing the work of this section with minimum 3 years documented experience and certified by the manufacturer.

**1.4                MOCK-UP**

- .1     Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2     Construct mock-up 10 m<sup>2</sup> minimum, of spray in place foam insulation including one inside corner and one outside corner. Mock-up may be part of finished work.

- .3 Allow 24 hours for inspection of mock-up by Consultant before proceeding with waterproofing work. Provide minimum 72 hours notice prior to construction of mock-up.

## **1.5 SAFETY REQUIREMENTS**

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

## **1.6 PROTECTION**

- .1 Ventilate area in accordance with Section 01 51 00 - Temporary Utilities.
- .2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour 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.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal.
- .2 Dispose of waste foam daily in location designated and decontaminate empty drums in accordance with local bylaws and regulations.
- .3 Divert metal drums from landfill to metal recycling facility as approved by Consultant and to CAN/ULC-S705.2.

## **1.8 ENVIRONMENTAL REQUIREMENTS**

- .1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
- .2 Toxicity/Hazardous Materials:
  - .1 Outgassing/Reactivity:
    - .1 Formaldehyde: Products containing urea-formaldehyde will not be permitted.
    - .2 Chlorofluorocarbons (CFCs)/HCFCs: Products and equipment requiring or using CFCs or HCFCs during the manufacturing process will not be permitted.
- .3 Airtightness: Meet specific standards of the Energy Star Program of 1.5 Air Changes/Hour at 50 Pa.

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**1.9 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- .2 Store materials in an area protected from freezing and overheating, and damage and in accordance with manufacturer's instructions.
- .3 Protect materials during handling and application to prevent damage and contamination.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Primers: in accordance with manufacturer's recommendations for surface conditions.
- .2 System 2:
  - .1 Polyurethane Foam: a spray polyurethane foam listed under CAN/ULC-S705.1-01, with CCMC listing for use as an insulation and for use as an air barrier material, with the following physical properties:
    - .1 Density (ASTM D-1622) minimum = 30.4 kg/m<sup>3</sup> (1.9 lb/ft.<sup>3</sup>)
    - .2 Compressive strength (ASTM D-1621), parallel to rise (10% compression) = 222 kPa (32 psi)
    - .3 Tensile strength (ASTM D-1623) = 337 kPa (49 psi)
    - .4 Open cell content (ASTM D-2856) = <1%
    - .5 Water absorption (ASTM D-2842) % by volume = 2.5%
    - .6 Dimensional stability (ASTM D-2126), % volume change after 28 days:
      - .1 20°C (-4°F) = 0.047%
      - .2 +100°C (212°F) = 8.45%
      - .3 +70°C (158°F) with relative humidity >90±3% = 7.64%
    - .7 Thermal resistance approved by the Standard CAN/ULC-S705.1-98
    - .8 Water vapour permeance (ASTM E-96), without the skins, core only = 125 ng/Pa.s.m<sup>2</sup>
    - .9 Flame spread classification (CAN/ULC-S102, including S127) = 375
    - .10 Smoke determined = 288
    - .11 VOC to be within the limits set in Section 01 47 18 – Indoor Air Quality Management
  - .2 Flame Retardant paint: Intumescent flame retarder paint recommended by insulation manufacturer to achieve flame spread rating of less than 25 in locations where insulation is exposed.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.

- .2 Verify that substrate is free of any foreign material that will impede application.
- .3 Verify that other work on and within spaces to be insulated is complete prior to application.
- .4 Notify Consultant of conditions that would adversely affect the application.
- .5 Beginning of installation means applicator accepts existing conditions.

### **3.2 PREPARATION**

- .1 Comply with manufacturer's written installation instructions for preparing substrates indicated to receive insulation.
- .2 Mask and protect adjacent surfaces from overspray or damage.
- .3 Remove foreign materials, dirt, grease, oil, paint, laitance, efflorescence, and other substances that will affect application.

### **3.3 APPLICATION**

- .1 Apply insulation in accordance with manufacturer's written application instructions.
- .2 Apply insulation to a reasonably uniform monolithic density without voids.
- .3 Apply to minimum cured thickness of 3" or as indicated.
- .4 Apply insulation to fill voids around doors and windows.
- .5 Apply insulation to fill voids around accessible service and equipment penetrations as noted on drawings. Use extension to fill behind equipment which is unable to be moved.
- .6 Apply insulation to seal voids at truss ends to prevent wind scouring of ceiling insulation.
- .7 Seal plumbing stacks, electrical wiring and other penetrations to control air leakage.
- .8 Where building is designed to meet the specific air-tightness standards of the Energy Star Program, apply insulation as recommended by manufacturer to provide airtight construction. Apply caulking to seal joints between structural assemblies.

### **3.4 FIELD QUALITY CONTROL**

- .1 Inspect application for insulation thickness and density.

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

- .1 Do not permit subsequent work to disturb applied insulation.

### **3.6 CONSTRUCTION WASTE MANAGEMENT**

- .1 Plan and coordinate the insulation work to minimize the generation of offcuts and waste. Reuse insulation scraps to the maximum extent feasible.

- .2 Separate and recycle waste materials in accordance with the Waste Management Plan and to the extent economically feasible.

**END OF SECTION**

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**PART 1      General**

**1.1            REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-19.13M-[M87], Sealing Compound, One Component, Elastomeric Chemical Curing.
  - .2 CAN/CGSB-19.18M-[M87], Sealing Compound, One Component, Silicone Base Solvent Curing.
  - .3 CAN/CGSB-19.24M-[M90], Multi-Component, Chemical Curing Sealing Compound.
  - .4 CGSB 19-GP-14M-[76], Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .2 NBCC 1995; Part 5 - Environmental Separation
- .3 Sealant and Waterproofers Institute - Sealant and Caulking Guide Specification.

**1.2            SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
  - .1 Provide drawings of special joint conditions.
- .2 Submit manufacturer's product data sheets in accordance with Section 013300 - Submittal Procedures.
- .3 Submit manufacturer's installation instructions in accordance with Section 013300 - Submittal Procedures.

**1.3            QUALITY ASSURANCE**

- .1 Perform Work in accordance with the Saskatchewan Masonry Institute - Professional Contractor Quality Assurance Program and requirements for materials and installation.
- .2 Maintain one copy of documents on site.

**1.4            QUALIFICATIONS**

- .1 Applicator: Company specializing in performing work of this section with minimum 5 years documented experience with installation of air/vapour barrier systems. Completed installation must be approved by the material manufacturer. .

**1.5            MOCK-UP**

- .1 Construct mock-up in accordance with Section 014500 - Quality Control.
- .2 Locate where directed
- .3 Mock-up may remain as part of the Work.



- 
- .4 Allow 24 h for inspection of mock-up by Engineer before proceeding with air/vapour barrier Work.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 016100 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Avoid spillage. Immediately notify Engineer if spillage occurs and start clean up procedures.
- .4 Clean spills and leave area as it was prior to spill.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

## **1.8 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 015100 - Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

## **1.9 SEQUENCING**

- .1 Sequence work in accordance with Section 013100 – Project Management and Coordination.
- .2 Sequence work to permit installation of materials in conjunction with related materials and seals.

## **1.10 WARRANTY**

- .1 For sealant and sheet materials the 12 months warranty period is extended to 24 months.
- .2 Warranty: Include coverage of installed sealant and sheet materials which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

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**PART 2 Products**

**2.1 SHEET MATERIALS**

- .1 Wall air barrier [Type 1]: SBS modified bitumen thermofusable elastomeric bitumen membrane reinforced with a glass mat, covered face and back with polypropylene film, minimum average thickness 2.5 mm. This membrane shall be applied by torching only.
- .2 Exterior wall sheathing paper [Type 2]: to CAN2-51.32, spunbonded, high density polyethylene fibres. Type as indicated

**2.2 RAINSCREEN LAYER**

- .1 Purpose made rain-screen product for application behind exterior cladding and in front of exterior sheathing.
  - .1 Thickness: 10mm
  - .2 Cross Sectional area: 80% open minimum.
  - .3 Recycled Content: 40% minimum
  - .4 Hydrophobic compound.
  - .5 Resistant to chemicals.
  - .6 Does not support mold growth.

**2.3 ACCESSORIES**

- .1 Primer: as recommended by membrane manufacturer. Appropriate to application.
- .2 Sealants in accordance with Section 079210 - Joint Sealing.
- .3 Substrate Cleaner: Non-corrosive type recommended by sealant manufacturer and compatible with adjacent materials.
- .4 Adhesive: Compatible with sheet seal and substrate, permanently non-curing.
- .5 Thinner and cleaner: As recommended by sheet material manufacturer.
- .6 Attachments: Galvanized steel bars and anchors.

**PART 3 Execution**

**3.1 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 the Engineer in writing.
- .4 Do not start work until deficiencies have been corrected. Commencement of Work implies acceptance of conditions.

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### **3.2 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 masonry joints struck 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 membrane and primer.
- .4 Ensure metal closures are free of sharp edges and burrs.
- .5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

### **3.3 INSTALLATION**

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Secure sheet seal to materials as per manufacturers recommendations. Position lap seal over firm bearing.
- .3 Place liquid seal to masonry materials by spray.
- .4 Lap sheet onto roof vapour retarder and seal. Caulk to ensure complete air seal. Position lap seal over firm bearing.
- .5 Ensure continuity of vapour and air barrier at window and door frames and adjacent wall. 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.

### **3.4 PROTECTION OF WORK**

- .1 Protect finished Work in accordance with Section 016100 - Common Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure finished Work is protected from climatic conditions.

### **3.5 SCHEDULES**

- .1 Wall Air/Vapour Barrier Over Outer Surface of Inner Wythe of Masonry: Torch sheet seal Type 1 over masonry unit surface to a thickness of 6 mm, seal masonry anchor penetrations air tight.
- .2 Wall Air/Vapour Barrier Over Exterior Surface of Sheathing: Place sheet seal Type 2 over sheathing surfaces.

- .3 Window Frame Perimeter: Lap sheet seal Type 1 from wall air seal surface with 75 mm of full contact over firm bearing to window frame with 25 mm of full contact.
- .4 Wall and Roof Junction: Lap sheet seal Type 1 from wall seal material with 150 mm of contact over firm bearing to roof air seal membrane with 100 mm of full contact.
- .5 Rainscreen – as indicated on drawings.

END OF SECTION

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**PART 1      General**

**1.1            REFERENCES**

- .1      Canadian Sheet Steel Building Institute
  - .1      Standard for Sheet Steel Cladding
- .2      American Society for Testing and Materials (ASTM)
  - .1      ASTM A924/A924M General Requirements for Steel Sheet Metallic Coated by the Hot Dip Process.
  - .2      ASTM A653/A653M- 95, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3      ECP-69-[94], Polyethylene Plastic Film Products.

**1.2            DESIGN REQUIREMENTS**

- .1      Drawings show the profile and extent of the metal cladding systems only. The Contractor is to supply all accessories and clips required to provide a system with concealed anchors.
- .2      Design preformed metal cladding system to withstand all design loads. Maximum allowable deflection of spans is 1/180.
- .3      Design system to provide movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to seasonal temperature ranges.
- .4      Design system to accommodate tolerances of structure, provided irregularities do not exceed them and clearance are maintained.
- .5      Provide for positive drainage to exterior, all water entering or condensation occurring within the preformed metal cladding system.

**1.3            SAMPLES**

- .1      Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2      Submit 2 samples, 600 mm long x full width of panel of material and colour of metal cladding required for the project.
- .3      Submit 2 samples of sealant material type and colour required for the project.

**1.4            SHOP DRAWINGS**

- .1      Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
- .2      Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, soffits, fascia, metal furring, and related work.

- .3 Shop drawings shall include elevations with panel layout and sections of each condition. Drawings shall include material type, metal thickness, finish, methods of installation and anchorage to accommodate thermal movement, panel length and width.
- .4 Shop drawings shall indicate details of anchors, including anchor size and spacing, and depth of penetration, for securing girts to substrate and metal cladding to girts.

## **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert used metal cut-offs from landfill by disposal into the on-site metals recycling bin.
- .2 Divert reusable materials for reuse at nearest used building materials facility.
- .3 Divert unused caulking, sealants, and adhesive materials from landfill through disposal at hazardous material depot.
- .4 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal, and with Waste Reduction Workplan.
- .5 Place materials defined as hazardous or toxic waste in designated containers.
- .6 Ensure emptied containers are sealed and stored safely for disposal away from children.

## **1.6 WARRANTY**

- .1 Provide the Owner with a written, extended warranty covering work of this section for a period of two (2) years from the date of Substantial Performance of the Work as certified by the Engineer.
  - .1 The Contractor shall correct promptly, at the Contractor's expense, defects or deficiencies in the Work that appear before and during the extended warranty period.
  - .2 The Contractor shall correct or pay for damage resulting from corrections made under the requirements for extended warranty.

## **PART 2 Products**

### **2.1 STEEL CLADDING AND COMPONENTS**

- .1 Cladding: to CGSB 93.4, Type A, vertical, Class: plain.
  - .1 Finish coating: Prefinished 8000 Series, grade A galvanized steel
  - .2 Colour: Section 090600 – Schedules for Finishes.
  - .3 Gloss: medium.
  - .4 Thickness: minimum 0.45 mm (26 gauge) base metal thickness.
  - .5 Profile: 39 mm deep, preformed interlocking joints.
- .2 Soffit: to CGSB 93.4, Class plain:
  - .1 Finish coating: to match cladding.
  - .2 Colour: to match cladding.
  - .3 Gloss: to match cladding
  - .4 Thickness: minimum 0.45 mm (26 gauge) base metal thickness.

- .5 Profile: flat sheet 'V' crimped for stiffness, 406 mm coverage, 3-rib panel, fully perforated.
- .6 Acceptable Products:
  - .1 VicWest S-16 Soffit Panel
- .3 Fascia facings and exposed trim: to CGSB 93.4, Class plain:
  - .1 Finish coating: to match cladding.
  - .2 Colour: to match cladding.
  - .3 Gloss: to match cladding.
  - .4 Thickness: minimum 0.45 mm (26 gauge) base metal thickness.
  - .5 Profile: manufacturer's standard as indicated.

## **2.2 ACCESSORIES**

- .1 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material, colour and gloss as cladding.
- .2 Z-Girts/C-Girts: Minimum 1.6 mm thick galvanized steel conforming to requirements of ASTM A653/A653M, with minimum 275 grams/m<sup>2</sup> coating as defined in ASTM A924/A924M. Height of girt to suit application and as detailed.
- .3 Fasteners: Manufacturer's standard corrosion resistant type to suit application, finish to match metal cladding when exposed.
- .4 Touch-up Paint: As recommended by panel manufacturer.
- .5 Isolation Coating: Bituminous paint.
- .6 Sheathing Paper: Exterior wall sheathing paper: to CAN2-51.32, spunbonded, high density polyethylene fibres. Type as indicated
- .7 Flexible Flashing: Non-woven polyester reinforcement with SBS modified bitumen. The upper surface shall be covered by a thermofusible plastic film, the underface shall be self-adhesive:
  - .1 Armourbond 180 by IKO Industries, average thickness of 3.0 mm;
  - .2 Modified Plus NP180 Tack Sheet by Monsey Bakor Inc., average thickness of 3.0 mm;
  - .3 Sopralene Flam Stick by Soprema Waterproofing Inc., average thickness of 2.5 mm.
- .8 Sealant: Section 079210 - Joint Sealing.

## **PART 3 Execution**

### **3.1 ACCEPTABLE INSTALLERS**

- .1 Installation of materials in this section shall be by the manufacturer's approved installers, in strict accordance with manufacturer's installation instructions.

- .2 The work of this section shall be performed by skilled workmen with at least three (3) years successful installation experience with the type of materials specified herein.
- .3 Submit evidence of experience and obtain Engineer's approval before proceeding with work.

### **3.2 INSTALLATION**

- .1 Install preformed metal cladding, as indicated on drawings, and in accordance with manufacturer's recommendations. Use continuous full-length sections.
- .2 Exercise care when cutting cladding on site, to ensure cuttings do not remain on finished surfaces.
- .3 Protect metal cladding surfaces in contact with cementitious materials and other dissimilar metals with bituminous paint. Allow protective coating to dry prior to installing members.
- .4 Permanently fasten metal cladding system to structural supports, properly aligned, levelled and plumb.
- .5 Maintain following installation tolerances:
  - .1 Maximum variation from plane or location shown on approved shop drawings: 10 mm/10 m of length.
  - .2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.
- .6 Locate end laps over supports. End lap panels minimum 50 mm. Ensure sidelaps are over firm bearing.
- .7 Use concealed fasteners in all locations except where approved by Engineer.
- .8 Provide notched and formed top closures, sealed to arrest direct weather penetration at vertical profiles. Ensure continuity of "pressure equalization" of rain screen principle.
- .9 Install inside and outside corners, edging, top trim, sill flashing and louver/window/door opening flashing as indicated, and as required.
- .10 Maintain joints in metal cladding, true to line, tight fitting, hairline joints.
- .11 Attach components in manner not restricting thermal movement.
- .12 Install sealant and gaskets where required to arrest direct weather penetration.
- .13 Seal junctions with adjoining work with sealant. Do work in accordance with Section 079210 - Joint Sealing.
- .14 Completed installation is to be free of rattles, noise due to thermal movement, and wind whistles. Provide weathertight assembly.



**3.3 CLEANING**

- .1 Wash down exposed metal cladding surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.
- .2 Remove excess sealant with recommended solvent.

END OF SECTION

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**PART 1      General**

**1.1            REFERENCES**

- .1 American Society for Testing and Materials (ASTM International)
  - .1 ASTM A653/A653M-[01a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian Roofing Contractors Association (CRCA)
  - .1 Roofing Specifications Manual [1997].
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.5-[M89], Cutback Asphalt Plastic Cement.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA B111-[1974(R1998)], Wire Nails, Spikes and Staples.

**1.2            SAMPLES**

- .1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
- .2 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, colour and finish.

**1.3            WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal.

**PART 2      Products**

**2.1            SHEET METAL MATERIALS**

- .1 Zinc coated steel sheet: minimum 0.46 mm (26 gauge) thickness, commercial quality to ASTM A653/A653M, with [Z275] designation zinc coating.

**2.2            PREFINISHED STEEL SHEET**

- .1 Prefinished steel with factory applied polyvinylidene fluoride.
  - .1 Class F1S.
  - .2 Colour: Section 090600 – Schedules for Finishes.
  - .3 Specular gloss: 30 units +/- in accordance with ASTM D523.
  - .4 Coating thickness: not less than 22 micrometres.
  - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20 % to ASTM D822 as follows:
    - .1 Outdoor exposure period 2500 hours.
    - .2 Humidity resistance exposure period 5000 hours.

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## **2.3 ACCESSORIES**

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
- .3 Sealants: Section 079210 - Joint Sealing.
- .4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .5 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
- .6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .7 Flexible Flashing: SBS modified bitumen elastomeric membrane reinforced with a non-woven polyester. The upper surface shall be covered by a thermofusable plastic film, the underface shall be self-adhesive, minimum average thickness 2.5 mm.
- .8 Touch-up paint: as recommended by prefinished material manufacturer.

## **2.4 FABRICATION**

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated.
- .2 Form pieces in 3000 mm minimum lengths. Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

## **2.5 EAVES TROUGHS AND DOWNPIPES**

- .1 Form eaves troughs and downpipes from minimum 0.60 mm thick prefinished sheet metal.
- .2 Sizes and profiles: minimum 125 mm x 125 mm eaves troughs, minimum 90 mm x 90 mm downpipe. All edges to be hemmed.
- .3 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

## **2.6 ALUMINUM FINISHES**

- .1 Finish exposed surfaces of aluminum components in accordance with AA DAF45.
  - .1 Clear anodic finish to match windows

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- .2 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative shall meet requirements of CAN/CSA-A440/A440.1, for coating Classes 1, 2 and 3 respectively.

**PART 3 Execution**

**3.1 INSTALLATION**

- .1 Install 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 (standing seams at roof) forming tight fit over hook strips, and as detailed.
- .5 Lock end joints and caulk with sealant.

**3.2 EAVES TROUGHS AND DOWNPIPES**

- .1 Install eaves troughs and secure to building at 750 mm on centre. Slope eaves troughs to downpipes as indicated. Seal joints watertight.
- .2 Install downpipes and provide goosenecks back to wall. Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.
- .3 Install splash pads as indicated.

END OF SECTION

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**Part 1            General**

**1.1                REFERENCES**

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

**1.2                SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit copy of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures
- .3 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control
  - .1 Test Reports:
    - .1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.
    - .2 Submit test results in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
  - .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

**1.3                QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: person specializing in sprayed-on fireproofing with minimum 5 years documented experience and approved by manufacturer.
- .2 Mock-ups:
  - .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

- .2 Apply fireproofing to approximately 10 square metres area of surfaces of mock-up-matching surface to be treated.
- .3 Mock-up will be used:
  - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
  - .2 For testing to determine compliance with performance requirements. Perform the following tests:
- .4 Locate where directed.
- .5 Allow 24 hours for inspection of mock-up by Engineer before proceeding with fireproofing work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .3 Deliver packaged materials in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
  - .1 Store materials in dry location.
  - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
  - .3 Damaged or opened containers will be rejected.
  - .4 Packaging to indicate shelf-life and materials to be applied prior to expiration of shelf-life.
  - .5 Provide temporary enclosures to prevent spray from contaminating air beyond application area.
  - .6 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing materials.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials in accordance with Section 01 74 21 - Construction Waste Management and Disposal

#### **1.5 AMBIENT CONDITIONS**

- .1 At temperatures less than 5 degrees C, ensure that 5 degrees C air and substrate temperature is maintained during and for 24 hours after application. Ensure that natural ventilation to properly dry the fireproofing during and subsequent to its application is provided. In enclosed areas lacking openings for natural ventilation, ensure that interior air is circulated and exhausted to the outside.
- .2 Maintain relative humidity within limits recommended fireproofing manufacturer.

- .3 Ensure that natural ventilation to properly dry fireproofing during and subsequent to its application is provided.
- .4 In enclosed areas lacking openings for natural ventilation, provide minimum of 4 air exchanges per hour by forced air circulation.

## **Part 2 Products**

### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 13 - Sustainable Requirements.
- .2 Do verification requirements in accordance with Section 01 47 13 - Sustainable Requirements

### **2.2 MATERIALS**

- .1 Sprayed fireproofing: ULC certified cementitious fireproofing qualified for use in ULC Designs specified.
- .2 Curing compound: type recommended by fireproofing manufacturer, qualified for use in ULC Designs specified.
- .3 Sealer: type recommended by fireproofing manufacturer, qualified for use in ULC Design specified.
- .4 Fireproofing: minimum dry density and cohesion/adhesion properties as follows:
  - .1 Fireproofing for structural components to be applied to a dry density and cohesion/adhesion strength as recommended by the manufacturer.
  - .2 Ensure spray-applied fireproofing: does not crack, spall or delaminate under downward deflection conditions over 3 m clear span.
  - .3 Minimum compressive strength: 48 kPa.
  - .4 Spray-Applied fireproofing material: not contribute to corrosion of test panels.
  - .5 Dust removal: not exceed 0.25 gram per square meter.

## **Part 3 Execution**

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

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

### **3.2 PREPARATION**

- .1 Substrate: free of material, which would impair bond.
- .2 Verify that painted substrate[s] are compatible and have suitable bonding characteristics to receive fireproofing.

- .3 Remove incompatible materials.
- .4 Ensure that items required to penetrate fireproofing are placed before installation of fireproofing.
- .5 Ensure that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is completed.

### **3.3 APPLICATION**

- .1 Apply bonding adhesive or primer to substrate if recommended by manufacturer.
- .2 Apply fireproofing to correspond with tested assemblies, or acceptable calculation procedures to provide fire resistance ratings as indicated on the drawings
- .3 Apply fireproofing over substrate, building up to required thickness to cover substrate with monolithic blanket of uniform density and texture.
- .4 Apply fireproofing directly to open web joists without use of expanded lath.
- .5 Tamp smooth, surfaces visible in finished work.
- .6 Apply curing compound to surface of cementitious fireproofing as required by manufacturer.
- .7 Apply sealer to surface of fireproofing as required by manufacturer in ventilation plenums and where fireproofing is to be painted.

### **3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .2 Inspection and Site Tests:
  - .1 Inspection and testing of fireproofing will be carried out by Testing Laboratory approved by Engineer and paid for as specified in Section 01 29 83 - Payment Procedures: Testing Laboratory Services.

### **3.5 PATCHING**

- .1 Patch damage to fireproofing caused by testing or by other trades before fireproofing is concealed, or if exposed, before final inspection.



**3.6 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Clean surfaces not indicated to receive fireproofing of sprayed material within 24 hours period after application.
- .3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**PART 1      General**

**1.1            REFERENCES**

- .1 Underwriter's Laboratories of Canada (ULC)
  - .1 ULC-S115-[1995], Fire Tests of Firestop Systems.

**1.2            SAMPLES**

- .1 Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

**1.3            SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
- .2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

**1.4            PRODUCT DATA**

- .1 Submit product data in accordance with Section 013300 - Submittal Procedures.
- .2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

**1.5            WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**PART 2      Products**

**2.1            SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 13 - Sustainable Requirements
- .2 Do verification requirements in accordance with Section 01 47 13 - Sustainable Requirements

**2.2            MATERIALS**

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

- .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended and conforming to special requirements specified in 3.5.
- .2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.
- .3 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

### **PART 3 Execution**

#### **3.1 PREPARATION**

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation [without interruption to vapour barrier].
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

#### **3.2 INSTALLATION**

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

- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to a neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

### **3.3 INSPECTION**

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

### **3.4 SCHEDULE**

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

### **3.5 CLEAN UP**

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

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**PART 1      General**

**1.1          REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-19.2-[M87], Glazing Compound, Nonhardening, Modified Oil Type.
  - .2 CGSB 19-GP-5M-[76], Sealing Compound, One Component, Acrylic Base, Solvent Curing.
  - .3 CAN/CGSB-19.6-[M87], Caulking Compound, Oil Base.
  - .4 CAN/CGSB-19.13-[M87], Sealing Compound, One-component, Elastomeric, Chemical Curing.
  - .5 CGSB 19-GP-14M-[76], Sealing Compound, One Component, Butyl-polyisobutylene Polymer Base, Solvent Curing.
  - .6 CAN/CGSB-19.17-[M90], One-Component Acrylic Emulsion Base Sealing Compound.
  - .7 CAN/CGSB-19.18-[M87], Sealing Compound, One Component, Silicone Base, Solvent Curing.
  - .8 CAN/CGSB-19.20-[M87], Cold-applied Sealing Compound, Aviation Fuel-resistant.
  - .9 CAN/CGSB-19.21-[M87], Sealing and Bedding Compound Acoustical.
  - .10 CAN/CGSB-19.22-[M89], Mildew Resistant, Sealing Compound for Tubs and Tiles.
  - .11 CAN/CGSB-19.24-[M90], Multi-component, Chemical Curing Sealing Compound.
- .2 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

**1.2          SUBMITTALS**

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

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

### **1.3 MOCK-UP**

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control
- .2 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant. Mock-up may be part of finished work.
- .3 Allow 24 hours for inspection of mock-up by Engineer before proceeding with sealant work.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, handle, store and protect materials in accordance with Section 01610 - Basic Product Requirements.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

### **1.5 ENVIRONMENTAL AND SAFETY REQUIREMENTS**

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

### **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction Waste Management And Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Dispose of surplus chemical and finishing materials in accordance with federal, provincial and municipal regulations.

- .5 Place used hazardous sealant tubes and other containers in areas designated for hazardous materials.

## **PART 2 Products**

### **2.1 SEALANT MATERIALS**

- .1 Sealants and caulking compounds must:
- .1 Meet or exceed all applicable governmental and industrial safety and performance standards; and
  - .2 Be manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising there from, will meet the requirements of all applicable governmental acts, by laws and regulations including, for facilities located in Canada, the fisheries Act and the Canadian Environmental Protection Act (CEPA).
- .2 Sealant and caulking compounds must not be formulated or manufactured with: aromatic solvents, fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, barium or their compounds, except barium sulfate.
- .3 Sealant and caulking compounds must not contain a total of volatile organic compounds (VOCs) exceeding the limits in Section 01 47 18 – Indoor Air Quality Management.
- .4 Sealant and caulking compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.
- .5 Caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant shall not be used in air handling units.
- .6 When low toxicity caulks are not possible, confine usage to areas which offgas to the exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off-gas time.
- .7 In the selection of the products and materials of this section preference will be given to those with the following characteristics: low Volatile Organic Compound (VOC) content, manufactured without compounds which contribute to ozone depletion in the upper atmosphere, manufactured without compounds which contribute to smog in the lower atmosphere, does not contain methylene chloride, does not contain chlorinated hydrocarbons.
- .8 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

### **2.2 SEALANT MATERIAL DESIGNATIONS**

- .1 Sealant A: Polyurethane Elastomeric Sealant, Two Part to CAN/CGSB-19.24
- .1 Non-sag or Self-Levelling as required by application
  - .2 Shore “A” Hardness at 14 Days: Non-sag 25 +/- 5, Self Levelling 40 +/- 5
  - .3 Colours to match adjacent materials, and as selected by Engineer.

- .2 Sealant B: Silicone, One Part.
  - .1 To CAN/CGSB-19.22 (Mildew resistant).
    - .1 Non-sag, one component, moisture curing
    - .2 Shore "A" Hardness at 14 Days: 25 +/- 5
    - .3 Non-staining and non-bleeding
    - .4 Colours to match adjacent materials, and as selected by Engineer.
- .3 Sealant C: Polyurethane, One Part to CAN/CGSB-19.13
  - .1 Non-sag, one component, moisture curing
  - .2 Shore "A" Hardness at 21 Days: 40 +/- 5
  - .3 Non-staining and non-bleeding
  - .4 Colours to match adjacent materials, and as selected by Engineer.
- .4 Sealant D: Polyurethane, One Part **Security Sealant**
  - .1 Non-sag, one component, moisture curing
  - .2 Shore "A" Hardness at 21 Days: 50 +/- 5
  - .3 Non-staining and non-bleeding
  - .4 Colours to match adjacent materials, and as selected by Engineer.
  - .5 Pick Resistant
  - .6 Acceptable Products: NO SUBSTITUTIONS
    - .1 Tremco Permaquik 2252
    - .2 Sika Anchor Fix 3
    - .3 Pecora Dynapoxy EP-430 Fast
    - .4 BASF Epolith G
    - .5 Pecora Dynapoxy EP 1200
- .5 Sealant E: Acoustical Sealant to CAN/CGSB-19.21
  - .1 Non-sag, one component, moisture curing
  - .2 Shore "A" Hardness at 14 Days: 25 +/- 5
  - .3 Non-staining and non-bleeding
  - .4 Colours to match adjacent materials, and as selected by Engineer.
- .6 Preformed Compressible and Non-Compressible back-up materials.
  - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
    - .1 Extruded closed cell foam backer rod.
    - .2 Size: oversize 30 to 50 %.
  - .2 Bond Breaker Tape.
    - .1 Polyethylene bond breaker tape which will not bond to sealant.

## 2.3 JOINT CLEANER

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



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**PART 3      Execution**

**3.1            PROTECTION**

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

**3.2            PREPARATION OF JOINT SURFACES**

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

**3.3            PRIMING**

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

**3.4            BACKUP MATERIAL**

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

**3.5            MIXING**

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

**3.6            APPLICATION**

- .1      Sealant.
  - .1      Apply sealant in accordance with manufacturer's written instructions.
  - .2      Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
  - .3      Apply sealant in continuous beads.
  - .4      Apply sealant using gun with proper size nozzle.
  - .5      Use sufficient pressure to fill voids and joints solid.
  - .6      Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing.
  - .1 Cure sealants in accordance with sealant manufacturer's instructions.
  - .2 Do not cover up sealants until proper curing has taken place.
- .3 Cleanup.
  - .1 Clean adjacent surfaces immediately and leave work neat and clean.
  - .2 Remove excess and droppings, using recommended cleaners as work progresses.
  - .3 Remove masking tape after initial set of sealant.

### **3.7 SEALANT SELECTION**

- .1 Sealant A:
  - .1 Perimeters of exterior openings where frames meet exterior facade of building
  - .2 Control and expansion joints in exterior surfaces of unit masonry walls
  - .3 All exterior locations noted on drawings for sealant
- .2 Sealant B:
  - .1 Vanity Back splashes
  - .2 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities)
  - .3 Cabinet work back splashes
- .3 Sealant C:
  - .1 All interior joints between dissimilar materials.
  - .2 All interior locations noted on drawings for sealant
- .4 Sealant D:
  - .1 All locations within secure areas where sealant is required.
  - .2 All locations in secure areas where joins between materials occur
- .5 Sealant E:
  - .1 All locations on drawings where acoustic sealant is shown
  - .2 All locations in sound rated assemblies where sealant is required.

END OF SECTION

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**PART 1      General**

**1.1          REFERENCES**

- .1 American Society for Testing and Materials (ASTM International)
  - .1 ASTM A653/A653M-[01a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM E90-90 - Standard test for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  - .3 ASTM E413-87 - Classification for Rating Sound Insulation
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.
  - .2 CGSB 41-GP-19Ma-[84], Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
  - .1 G40.20/G40.21-[98], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59-[M1989(R2001)], Welded Steel Construction (Metal Arc Welding) (Metric Version).
- .4 Canadian Steel Door Manufacturers' Association, (CSDMA).
  - .1 CSDMA, Specifications for Commercial Steel Doors and Frames, [1990].
  - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, [1990].
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN4-S104-[80(R1985)], Fire Tests of Door Assemblies.
  - .2 CAN4-S105-[85(R1992)], Fire Door Frames Meeting the Performance Required by CAN4-S104.
- .6 CAN/ULC-S701-[01], Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .7 CAN/ULC-S702-[97], Thermal Insulation, Mineral Fibre, for Buildings.
- .8 CAN/ULC-S704-[01], Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

**1.2          SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
- .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware, fire rating, finishes, and STC rating.

- .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, fire rating, finishes and STC rating.
- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

### **1.3 SAMPLES**

- .1 Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2 Submit one 300 x 300 mm butt corner sample of each type door.
- .3 Submit one 300 x 300 mm corner sample of each type of frame.
  - .1 Show butt cutout, glazing stops.

### **1.4 REQUIREMENTS**

- .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M [NFPA 252] for ratings specified or indicated.
- .2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN4-S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

### **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal.

## **PART 2 Products**

### **2.1 MATERIALS**

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, [ZF75], 1.2 mm minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, [ZF75].

### **2.2 DOOR CORE MATERIALS**

- .1 Honeycomb construction:
  - .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m<sup>3</sup> minimum sanded to required thickness.
- .2 Stiffened: face sheets welded, insulated core.

.1 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m<sup>3</sup>.

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250 degrees Celsius at 30 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

### **2.3 ADHESIVES**

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

.3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

.4 VOC's: in accordance with the limits in Section 01 47 18 – indoor Air Quality Management

### **2.4 PRIMER**

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

### **2.5 PAINT**

.1 Field paint steel doors and frames in accordance with Section 099120 – Interior Painting. Protect weatherstrips from paint. Provide final finish shall be free of scratches or other blemishes.

### **2.6 ACCESSORIES**

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

.2 Exterior and interior top and bottom caps: steel.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

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

.5 Fire labels: metal riveted.

.6 Sealant: Section 079210 - Joint Sealing.

.7 Glazing: Section 088050 - Glazing

.8 Make provisions for glazing as indicated and provide necessary glazing stops.

- .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
- .2 Design exterior glazing stops to be tamperproof.

## **2.7 FRAMES FABRICATION GENERAL**

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.6 mm welded type construction.
- .4 Interior frames: 1.6 mm welded type construction.
- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .6 Frame strike bucket to be able to accept 25 mm throw dead bolt.
- .7 Protect mortised cutouts with steel guard boxes.
- .8 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .9 Manufacturer's nameplates on frames and screens are not permitted.
- .10 Conceal fastenings except where exposed fastenings are indicated.
- .11 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .12 Insulate exterior frame components with polyurethane insulation.

## **2.8 FRAME ANCHORAGE**

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

## **2.9 FRAMES: WELDED TYPE**

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

## **2.10 DOOR FABRICATION GENERAL**

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior doors: hollow steel construction. Interior doors: honeycomb construction.
- .3 Doors to be 45 mm thick.
- .4 Fabricate doors with longitudinal edges locked seam and welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .5 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware.
- .6 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .7 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .8 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .10 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .11 Manufacturer's nameplates on doors are not permitted.

## **2.11 DOORS: HONEYCOMB CORE CONSTRUCTION**

- .1 Form each face sheet for interior doors from 1.6 mm sheet steel with honeycomb or temperature rise rated core laminated under pressure to face sheets.

## **2.12 HOLLOW STEEL CONSTRUCTION**

- .1 Form each face sheet for exterior doors from 1.6 mm sheet steel.
- .2 Form each face sheet for interior doors from 1.6 mm sheet steel.

- .3 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 150 mm on centre maximum.
- .4 Fill voids between stiffeners of exterior doors with polyurethane core.

### **2.13 THERMALLY BROKEN DOORS AND FRAMES**

- .1 All exterior doors and frames to be thermally broken.
- .2 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .3 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .4 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .5 Apply insulation.

### **2.14 ACOUSTIC DOORS AND FRAMES**

- .1 Form each face sheet from 1.6 mm sheet steel.
- .2 Door and frame assembly shall be tested and certified to meet STC rating as indicated in conformance with ASTM E90-90 and ASTM E413-87.
- .3 Acceptable Product:
  - .1 Ambico Limited:  
1120 Cummings Avenue,  
Ottawa, Ontario  
Phone: 888-423-2224 Fax: 800-465-8561
  - .2 Kruger Doors.

## **PART 3 Execution**

### **3.1 INSTALLATION GENERAL**

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

### **3.2 FRAME INSTALLATION**

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.



- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier and/or vapour retarder.

### **3.3 DOOR INSTALLATION**

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 087110 - Door Hardware - General.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
  - .1 Hinge side: 1.0 mm.
  - .2 Latchside and head: 1.5 mm.
  - .3 Finished floor, top of carpet and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.
- .4 Install louvres.

### **3.4 FINISH REPAIRS**

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

### **3.5 GLAZING**

- .1 Install glazing for doors and frames in accordance with Section 088050 - Glazing.

END OF SECTION

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**PART 1      General**

**1.1          REFERENCES**

- .1 American Society for Testing and Materials (ASTM International)
  - .1 ASTM A653/A653M-[01a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.
  - .2 CGSB 41-GP-19Ma-[84], Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
  - .1 G40.20/G40.21-[98], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59-[M1989(R2001)], Welded Steel Construction (Metal Arc Welding) (Metric Version).
- .4 Canadian Steel Door Manufacturers' Association, (CSDMA).
  - .1 CSDMA, Specifications for Commercial Steel Doors and Frames, [1990].
  - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, [1990].
- .5 HMMA – NAAMM 863-98, ASTM F1450-97 – Grade 3 Level.

**1.2          DESIGN REQUIREMENTS**

- .1 Perform all work to assure completed areas are vandal proof and that no items can be removed without special equipment.
- .2 There shall be no sharp materials, rough or jagged items or material exposed within the detention area.
- .3 All joins are to be caulked smooth with security sealant.
- .4 Schematic drawings and details have been provided for reference only. All detention doors are to meet or exceed Level 3 NAAMM 863-98, ASTM F1450-97 baseline performance criteria. Manufacturer to submit certification.

**1.3          SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
- .2 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .3 Clearly show all pertinent dimensions, general construction, materials (including gauges and finish of material parts), component connections and locations, anchorage methods and locations, hardware locations, and installation details.

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**1.4 SAMPLES**

- .1 Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2 Submit 1 sample, 300 x 300 mm of top butt corner of door required for the project.
  - .1 Show butt cutout.
- .3 Submit 1 sample, 300 x 300 mm of top butt corner of frame required for the project.
  - .1 Show anchors and butt cutout.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal.

**PART 2 Products**

**2.1 MANUFACTURERS**

- .1 Detention Hardware:
  - .1 Chubb
  - .2 Southern Folger
  - .3 RR Brink.

**2.2 DETENTION DOORS**

- .1 Doors shall have 14 gauge wipecoat galvanized steel faces spot-welded to internal framework. Door internal frame shall be constructed with 3 mm hollow structural steel tube, run both vertically and horizontally. Internal reinforcing to be a fully welded skeleton. Doors to be prepared for key operated deadlock, keyed one side. Hinges to be suitably sized and ordered to minimise projection of hinge knuckles beyond door and frame. Provide 1 ½ pair with non-removable pins.  
Provide doors with 145 mm x 475 mm clear opening View Lite complete with glazing consisting of one layer of 6.5 mm Lexguard and one layer of 6.5 mm Lexan security Lexan, and operable Viewport Shutter and Food Pass Flap with spring catch and clear opening of 305 mm x 115 mm clear opening. View Lite, Viewport Shutter and Food Pass Flap to be factory installed into door. Interior Lexguard to be rabbetted to provide flush finish with inside door face.
- .2 Swing Detention Door Frames: Detention door frames shall be 3 mm hot rolled steel, mortised to accept security strike. Frame prepared for correct anchoring system compatible with the wall type. Frames to be supplied with fully welded construction. All exposed parts to be epoxy primed.  
All exposed parts to be epoxy primed.
  - .1 Acceptable Products:
    - .1 CP Distributors Trackset CP-120-A.
    - .2 CORCAN Sales
- .3 Swing Door Locksets: Locksets tumbler paracentric deadlock, to unlock with a half turn of the key and lock with a full turn of the key. Locks complete with mounting plate,

strike and single notch escutcheon. All fasteners must be Phillips or Allen, button head machine screws.

- .1 Acceptable Products:
  - .1 Chubb – 1080-1
  - .2 Folger Adam – 82
  - .3 Southern Steel – 1080-1
  - .4 RR Brink - 7082

.4 Flush Door Pulls: Door pulls cast brass, flush mount. Pull complete with Phillips or Allan head screws.

- .1 Acceptable Products:
  - .1 Folger Adam #4 x 32D.

## **2.3 COMPONENTS**

.1 Keying: Keying shall be factory registered with Folger Adam Security and correspond with the Detachment Name or Location as the reference. Total of three keys per project are to be supplied. All locks are to be keyed alike.

## **2.4 PRIMER**

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

## **2.5 PAINT**

.1 Field paint steel doors and frames in accordance with Section 099123 – Interior Painting. Provide final finish shall be free of scratches or other blemishes.

## **2.6 ACCESSORIES**

- .1 Fasteners: All screws shall be Phillips or Allen head screws, compatible with the material they are fastening as well as the material they are securing into. Two of each size bit that is required shall be supplied.
- .2 Metallic paste filler: to manufacturer's standard.
- .3 Sealant: Section 079210 - Joint Sealing

## **PART 3 Execution**

### **3.1 INSTALLATION GENERAL**

- .1 Install doors and frame Installation of materials of this section shall be by the manufacturer's approved installers, in strict accordance with manufacturer's installation instructions, and in accordance with Section 017303, Execution Requirements.
- .2 The work of this section shall be performed by skilled workers with at least five (5) years successful installation experience with the type of materials specified herein.
- .3 Submit evidence of experience and obtain Engineer's approval before proceeding with work.

- .4 Install doors, tracksets and hardware by factory trained and authorized installers.

### **3.2 FRAME INSTALLATION**

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.

### **3.3 DOOR INSTALLATION**

- .1 Install sliding detention doors, frames and hardware and frames in accordance with construction documents, shop drawings, manufacturer's recommendations and Section 017303, Execution Requirements
- .2 Install sliding detention doors, frames and hardware and frames plumb and square, in correct locations and with maximum diagonal distortion of 2 mm. Ensure frames are securely and rigidly anchored to adjacent construction.
- .3 Frames shall be solidly braced at time of installation both vertically and horizontally and solidly blocked within the frame opening to prevent bowing of the frame when it is grout filled.
- .4 Bed anchors of hollow metal frames in mortar joints of masonry walls. Fill frame voids solid with mortar.

### **3.4 FINISH REPAIRS**

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

### **3.5 GLAZING**

- .1 Install glazing for doors in accordance with Section 088050 - Glazing.

END OF SECTION

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**PART 1      General**

**1.1          REFERENCES**

- .1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
  - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-69.17-[M86(R1993)], Bored and Preamsembled Locks and Latches.
  - .2 CAN/CGSB-69.18-[M90]/ANSI/BHMA A156.1-[1981], Butts and Hinges.
  - .3 CAN/CGSB-69.19-[93]/ANSI/BHMA A156.3-[1984], Exit Devices.
  - .4 CAN/CGSB-69.20-[M90]/ANSI/BHMA A156.4-[1986], Door Controls (Closers).
  - .5 CAN/CGSB-69.21-[M90]/ANSI/BHMA A156.5-[1984], Auxiliary Locks and Associated Products.
  - .6 CAN/CGSB-69.22-[M90]/ANSI/BHMA A156.6-[1986], Architectural Door Trim.
  - .7 CAN/CGSB-69.24-[M90]/ANSI/BHMA A156.8-[1982], Door Controls - Overhead Holders.
  - .8 CAN/CGSB-69.26-[96]/ANSI/BHMA A156.10-[1991], Power-operated Pedestrian Doors.
  - .9 CAN/CGSB-69.28-[M90]/ANSI/BHMA A156.12-[1986], Interconnected Locks and Latches.
  - .10 CAN/CGSB-69.29-[93]/ANSI/BHMA A156.13-[1987], Mortise Locks and Latches.
  - .11 CAN/CGSB-69.30-[93]/ANSI/BHMA A156.14-[1991], Sliding and Folding Door Hardware.
  - .12 CAN/CGSB-69.31-[M89]/ANSI/BHMA A156.15-[1981], Closer/Holder Release Device.
  - .13 CAN/CGSB-69.32-[M90]/ANSI/BHMA A156.16-[1981], Auxiliary Hardware.
  - .14 CAN/CGSB-69.33-[M90]/ANSI/BHMA A156.17-[1987], Self-closing Hinges and Pivots.
  - .15 CAN/CGSB-69.34-[93]/ANSI/BHMA A156.18-[1987], Materials and Finishes.
  - .16 CAN/CGSB-69.35-[M89]/ANSI/BHMA A156.19-[1984], Power Assist and Low Energy Power Operated Doors.
  - .17 CAN/CGSB-69.36-[M90]/ANSI/BHMA A156.20-[1984], Strap and Tee Hinges and Hasps.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-69 / ANSI/BHMA A156, Builders Finishing Hardware, Latest Editions.

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## **1.2 REQUIREMENTS REGULATORY AGENCIES**

- .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

## **1.3 SAMPLES**

- .1 Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
- .3 After approval samples will be returned for incorporation in the Work.

## **1.4 HARDWARE LIST**

- .1 Submit contract hardware list in accordance with Section 013300 - Submittal Procedures.
- .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .3 Hardware list shall be submitted with a minimum of one copy of manufacturers published literature for each item of hardware to be supplied.
- .4 Hardware list shall be submitted with a complete list of abbreviations applicable to hardware list.
- .5 Hardware list shall indicate angle at which door is restrained by hold open device.
- .6 All hardware lists including key controls must be reviewed and signed off by Security Engineering Section to ensure continuity of security and hardware compatibility with existing division hardware.

## **1.5 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for door closers, locksets, door holders and fire exit hardware for incorporation into manual specified in Section 017800 - Closeout Submittals.
- .2 Brief maintenance staff regarding proper care, cleaning, and general maintenance.
- .3 The supplier of Door Hardware is to examine the installation of all hardware on site and provide the Engineer with a Certificate of Inspection stating all hardware and accessories have been inspected and are installed in a manner consistent with requirements of the specifications, drawings and manufacturers recommendations. Hardware Certificate of Inspection shall be submitted prior to date of Interim Certificate of Completion.

## **1.6 MAINTENANCE MATERIALS**

- .1 Provide maintenance materials in accordance with Section 017800 - Closeout Submittals.
- .2 Supply two sets of wrenches for each different type of hardware, including door closers, locksets and fire exit hardware.

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**1.7 DELIVERY AND STORAGE**

- .1 Deliver, store, handle and protect materials in accordance with Section 016100 - Common Product Requirements.
- .2 Store finishing hardware in locked, clean and dry area.
- .3 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

**1.8 WARRANTY**

- .1 For the work of this Section 087110 - Door Hardware - General, the 12 month warranty period is extended to 24 months.

**1.9 WASTE DISPOSAL AND MANAGEMENT**

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

**PART 2 Products**

**2.1 HARDWARE ITEMS**

- .1 Use one manufacturer's products only for all similar items.
- .2 Locks shall be wrought brass with lever handles.
- .3 Hardware except items otherwise specified shall be:
  - .1 ANSI 626 Satin Chromium
- .4 Interior butts steel plated. Exterior butts and interior butts to all washrooms and showers to be stainless steel.
- .5 Provide ULC approved hardware at all ULC labelled doors.

**2.2 DOOR HARDWARE**

- .1 Butts and hinges:
  - .1 To ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
  - .2 Type A1:
    - .1 Hager BB 1279  
Mont-Hard BB 1079  
Stanley FBB 179  
114 x 102 663 1½ pairs to each door.
    - .2 Hager BB 1191 (stainless steel)  
Mont-Hard STSBB991 (stainless steel)  
Stanley FBB 191 (stainless steel)  
114 x 102 630 1½ pairs to each door.
  - .3 Type A2:



- 
- .1 Heavy duty, 127 x 127 mm, stainless steel or bronze, five knuckle ball bearing, non-removable pin hinges 1½ pair to each door. Hager BB 1199
  - .4 Type A3:
    - .1 Full mortise continuous stainless steel hinge:  
Model No. FM-300-32D by Markar Products Inc.
  - .2 Locks and latches:
    - .1 Auxiliary locks and associated products to: ANSI/BHMA A156.5, Grade 1, designed for function as stated in Hardware Schedule.
      - .1 Manufacturer: Corbin Russwin, CL3300 Series (LWR Levers) complete with L4 restricted keyway, **(no substitutions)**.
      - .2 70 mm Backset
    - .2 Mortise locks and latches to: ANSI/BHMA A156.13, Grade 1, designed for function as stated in Hardware Schedule.
      - .1 Manufacturer Corbin Russwin, ML2000 Series (LWR Levers) complete with L4 restricted keyway, **(no substitutions)**.
    - .3 Locks or cylinders having core removable functions are not acceptable.
    - .4 The same make and keyway must be used on all locks throughout the Contract. EXCEPTION: cell block and overhead door locks, and as indicated on Lockset Schedule.
    - .5 Cylinders must be “0” bitted L4 Cylinders.
    - .6 Norman strikes: box type, lip projection not beyond jamb.
    - .7 Cylinders key into keying system as directed.
  - .3 Door Closers and Accessories:
    - .1 Door controls (closers): to ANSI/BHMA A156.4, listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4, table A1.
    - .2 The force required to open any door shall not exceed 38 N for exterior doors and 22 N for interior doors. Closers at exterior doors shall be equipped with adjustable spring power assists (multi-sized to permit setting of spring power from size 2 through size 6).
    - .3 Closers for interior doors shall have a closing period of not less than 3 seconds measured from when the door is in an open position of 700 to the doorway, to when the door reaches a point 75 mm from the closed position, measured from the leading edge of the latch side of the door.
    - .4 Closer Finish: Painted to match finish of other hardware components.
  - .4 Kickplates: to ANSI/BHMA A156.6, listed in Hardware Schedule.
    - .1 1.3 mm thick aluminum rectangular kickplate with square corners and beveled edges (4 sides) – 40 mm less than width of door on stop side. Mount bottom of kickplate 2 mm above bottom of door. 1 side 250 mm high.
  - .5 Pushes and Pulls: to ANSI/BHMA A156.6, designated by letter J and numeral identifiers listed in Hardware Schedule.  
Push plates: 1.27 mm thick stainless steel:
    - .1 J1. Push/Pull: 25 mm diameter, 380 mm long pull Type J401, complete with 125 x 500 back plate Type J405, all stainless steel x 630.

- .2 J2. Push Plate: 125 x 500 Type J301 rectangular push plate with square corners and beveled edges, stainless steel x 630.
- .6 Stops: In accordance with ANSI/BHMA A156.16, and A156.8 designated by letter K and numeral identifiers listed in Hardware Schedule:
- .1 K1. L02141/L02161 floor type.
- .2 K2. L02251 wall type (concave).
- .3 K3. CO2541 (A156.8) overhead type.
- Where doors are shown on drawings as stopping against solid walls or partitions, provide doors with a L02251 wall type (concave) stop. Where doors are shown on drawings as stopping against glazed screens, cabinetwork or plumbing fixtures, provide doors with a L02141/L02161 floor type stop.
- .7 Weatherstripping:
- .1 Weatherstripping: In accordance with ANSI/BHMA A156.22, as listed in Hardware Schedule or as listed and as specified:
- .1 Doors as scheduled are to be provided with the following weatherstripping:
- .2 Head and Jamb: R3C164/5, nominal 6 x 40 mm.
- .3 Door Sills: R3B414/5, nominal 6 x 45 mm.
- .4 Weather stripping on acoustically rated doors is to conform with STC rating of door.
- .8 Thresholds: In accordance with ANSI/BHMA A156.21, and as specified:  
Provide threshold J32100, fluted top at interior locations scheduled.  
Width to match adjacent pressed steel frame.  
Provide threshold J32190, thermal break and fluted top at exterior locations scheduled.  
Width to match adjacent pressed steel frame.
- .9 Auxiliary hardware: to ANSI/BHMA A156.16, to be included on all doors:
- .1 Door Bumpers: L03011, standard resilient type rubber:  
Place minimum of 3 single bumpers on single door frames. Space equally along strike jambs. Place minimum of 2 single bumpers on double door frames. Place on frame heads.
- .10 Accessories: to ANSI/BHMA A156.16, designated by letter L and numeral identifiers, as listed in Hardware Schedule or as listed below:
- .1 L1 - Door Viewer: L03221.

Acceptable Products:

**Loxem 190**

Manufactured by  
VSI Hardware Industries  
12930 Bradley Avenue  
P.O. Box 4445  
Symlar, California 91342

Available in Canada from:

Taymour Industries  
1170 William Street  
Vancouver, B.C.

**Madison No.20 R35**

Manufactured by:  
Madison Products Company Limited

Available in Canada from:  
Madison Products Company Limited  
804-90<sup>th</sup> Avenue  
LaSalle, Quebec

Madison Products Company Limited  
3840 Jacombs Road  
Unit 21 Richmond, B.C.

Madison Products Company Limited  
550 Sheppard Avenue, Unit 25  
Agincourt, Ontario

**Ives No.698B3**

Manufactured by:  
Leigh Metal Products Ltd.  
101 Brookside Street  
London, Ontario, N6A 4Y3

Metallic Industrial Grade Door Viewer

- .2 L3 - Aluminum Sliding Window shutter as detailed on drawings.
  - .3 L4 - Flush Bolts: Automatic UL rated.
  - .4 L5 - Astragal: Overlapping, extruded aluminum frame with pile insert, finished to match doors. Provide on all double doors
  - .5 L6 – Removable Mullion. Keyed to match door.
- .11 Power Lead Transfer Cover: Abloy EA281; required on all doors with a Sargent 8271 electrified lockset.

**2.3 FASTENINGS**

- .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .2 Exposed fastening devices to match finish hardware.
- .3 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .4 Use fasteners compatible with material through which they pass.
- .5 Secure astragals with non-removable screws, pop rivets and/or carriage bolts bolted from the interior.

**2.4 KEYING**

- .1 Install “0” bitted cylinders to test for proper lock operation. Perimeter doors may be fitted with random bitted L4 cylinders if required for perimeter security.
- .2 Provide 2 uncut key blanks for every lock in this Contract.

- .3 Final keying will be provided by Owner.
- .4 Key blanks to be stamped "DO NOT COPY"

**PART 3 Execution**

**3.1 INSTALLATION INSTRUCTIONS**

- .1 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .2 Furnish manufacturers' instructions for proper installation of each hardware component.
- .3 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .4 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .5 Remove construction cores when directed by Engineer; install permanent cores and check operation of all locks.
- .6 Mitre or cope inside corners of weatherstripping at junction of head to jamb.
- .7 Set thresholds in two continuous beads of sealant. Sealant in accordance with Section 079210 - Joint Sealing.

**3.2 LOCKSET SCHEDULE**

- .1 The following lockset schedule is to be read in conjunction with the schedule on the drawings. No Substitutions are to be made with Models specified

DOOR NUMBER	LOCKSET SPECIFICATIONS				ADDITIONAL COMMENTS
	TYPE	MANUFACTURER	MODEL	ANSI NO.	
100	Mortise	Corbin-Russwin	ML2029-LWR-626 L4 Cylinder '0'Bitted	F15	No indicator on trim. This lockset has lever handles.
101	Mortise	Corbin-Russwin	ML2057-GSR-626 L4 Cylinder '0'Bitted	F07 (K)	
102	Mortise	Corbin-Russwin	ML2022-GSR-626 L4 Cylinder '0'Bitted	F14 (K)	
102.1	Mortise	Corbin-Russwin	ML2022-GSR-626 L4 Cylinder '0'Bitted	F14 (K)	
103	Mortise	Corbin-Russwin	ML2057-GSR-626 L4 Cylinder '0'Bitted	F07 (K)	Please use GSR Trim. This lockset requires a knob handle.
104	Mortise	Corbin-Russwin	ML2011 L4 Cylinder '0'Bitted	F18	
105	Mortise	Corbin-Russwin	ML2057-GSR-626	F07 (K)	Please use GSR Trim. This

			L4 Cylinder '0'Bitted		lockset requires a knob handle.
106	Mortise	Corbin-Russwin	ML2057-GSR-626 L4 Cylinder '0'Bitted	F07 (K)	
107	Mortise	Corbin-Russwin	ML2022-GSR-626 L4 Cylinder '0'Bitted	F14 (K)	
107.1	Mortise	Corbin-Russwin	ML2022-GSR-626 L4 Cylinder '0'Bitted	F14 (K)	
108	Mortise	Corbin-Russwin	ML2022-GSR-626 L4 Cylinder '0'Bitted	F14 (K)	
200	Mortise	Corbin-Russwin	ML2029-LWR-626 L4 Cylinder '0'Bitted	F15	No indicator on trim. This lockset has lever handles.
201					See Detention Door Hardware
201.1	Mortise	Corbin-Russwin	ML2011 L4 Cylinder '0'Bitted	F18	
202	Mortise	Corbin-Russwin	ML2022-GSR-626 L4 Cylinder '0'Bitted	F14 (K)	
202.1	Mortise	Corbin-Russwin	ML2022-GSR-626 L4 Cylinder '0'Bitted	F14 (K)	
203	Mortise	Corbin-Russwin	ML2010-GSR-626	F01 (K)	
206	Mortise	Corbin-Russwin	ML2022-GSR-626 L4 Cylinder '0'Bitted	F14 (K)	
206.1	Mortise	Corbin-Russwin	ML2022-GSR-626 L4 Cylinder '0'Bitted	F14 (K)	
207					See Detention Door Hardware
207.1	Mortise	Corbin-Russwin	ML2011 L4 Cylinder '0'Bitted	F18	

END OF SECTION

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**PART 1      General**

**1.1            REFERENCES**

- .1      American Society for Testing and Materials (ASTM)
  - .1          ASTM D 2240-[97e1], Test Method for Rubber Property - Durometer Hardness.
  - .2          ASTM F 1233-[98], Test Method for Security Glazing Materials and Systems.
- .2      Canadian Door and Window Manufacturers, Certification Program.
- .3      Canadian General Standards Board (CGSB)
  - .1          CAN/CGSB-12.1-[M90], Tempered or Laminated Safety Glass.
  - .2          CAN/CGSB-12.3-[M91], Flat, Clear Float Glass.
  - .3          CAN/CGSB-12.4-[M91], Heat Absorbing Glass.
  - .4          CAN/CGSB-12.5-[M86], Mirrors, Silvered.
  - .5          CAN/CGSB-12.8-[97], Insulating Glass Units.
  - .6          CAN/CGSB-12.10-[M76], Glass, Light and Heat Reflecting.
  - .7          CAN/CGSB-12.11-[M90], Wired Safety Glass.
- .4      Flat Glass Manufacturers Association (FGMA), Glazing Manual
- .5      Laminators Safety Glass Association, Standards Manual.

**1.2            PERFORMANCE REQUIREMENTS**

- .1      Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
  - .1          Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
- .2      Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to a minimum design pressure of 0.5 kPa.
- .3      Limit glass deflection to 1/200 with full recovery of glazing materials.

**1.3            SHOP DRAWINGS**

- .1      Submit shop drawings in accordance with Section 013300 - Submittal Procedures.

**1.4            SAMPLES**

- .1      Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2      Submit duplicate 300x300 mm size samples of each type of glazing material

**1.5            MOCK-UPS**

- .1      Construct mock-ups in accordance with Section 014500 - Quality Control.

- .2 Construct mock-up to including glazing, and perimeter air barrier and vapour retarder seal.
- .3 Construct mock-up where directed.
- .4 Allow 24 hours for inspection of mock-up by Engineer before proceeding with work.
- .5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

## **1.6 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 017800 - Closeout Submittals.

## **1.7 QUALITY ASSURANCE**

- .1 Perform work in accordance with FGMA Glazing Manual.
- .2 Provide testing and analysis of glass under provisions of Section 014500 - Quality Control.
- .3 Provide shop inspection and testing for glass.

## **1.8 ENVIRONMENTAL REQUIREMENTS**

- .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.

## **1.9 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal.

## **1.10 PACKAGING MATERIALS**

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Dispose of all packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

## **PART 2 Products**

### **2.1 MATERIALS: FLAT GLASS**

- .1 Safety glass: to CAN/CGSB-12.1, transparent, minimum 6mm thick.
  - .1 Type: tempered.
  - .2 Class: float.

- .3 Category: 1.
- .2 Silvered mirror glass: to CAN/CGSB-12.5, minimum 6 mm thick.
  - .1 Type: Tempered.
- .3 Polycarbonate security glazing:
  - .1 Single 6 mm thick polycarbonate sheet, clear colour.
  - .2 Ballistic performance: to ASTM F 1233.
  - .3 Flexural strength: to ASTM D 790.
  - .4 Light transmittance: minimum 88% to ASTM D 1003.
  - .5 Surface burning characteristics for flame and smoke spread: to ASTM E 84.
  - .6 Self ignition characteristics: to ASTM D 1929.
  - .7 Acceptable manufacturer:
    - .1 Lexan
- .4 Laminated Safety Glass
  - .1 2 layers of 6mm laminated safety glass with a 0.030mm PVB interlayer.

## 2.2 ACCESSORIES

- .1 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D 2240, length of 25 mm for each square meter of glazing to suit glazing method, glass light weight and area.
- .2 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D 2240, 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 D 2240; 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%, to effect an air and vapour seal.
- .4 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, colour as selected.
- .5 Lock-strip gaskets: to ASTM C 542.
- .6 Mirror attachment accessories:
  - .1 Stainless steel clips.



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**PART 3 Execution**

**3.1 EXAMINATION**

- .1 Verify that openings for glazing are correctly sized and within tolerance.
- .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

**3.2 PREPARATION**

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

**3.3 INSTALLATION: EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)**

- .1 Cut glazing tape to length and set against permanent stops, 6 mm below sight line. Seal corners by butting tape and dabbing with sealant.
- .2 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.
- .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 and heel head of sealant with sufficient pressure to attain full contact at perimeter of light or glass unit.
- .5 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.
- .6 Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, maximum 9 mm below sight line.
- .7 Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

**3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)**

- .1 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .2 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .3 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .4 Place glazing tape on free perimeter of glazing in same manner described.

- .5 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .6 Knife trim protruding tape.

### **3.5 INSTALLATION: MIRRORS**

- .1 Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.
- .2 Set mirrors with clips. Anchor rigidly to wall construction.
- .3 Set in frame.
- .4 Place plumb and level.

### **3.6 CLEANING**

- .1 Remove glazing materials from finish surfaces.
- .2 Remove labels after work is complete.
- .3 Clean glass and mirrors.

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

- .1 After installation, mark light with an "X" by using removable plastic tape or paste.

### **3.8 SCHEDULE**

- .1 Polycarbonate security glazing:
  - .1 All glazing located within secure area.
  - .2 Cell door glazing.

END OF SECTION

**PART 1      General**

- .1      All finishes subject to final approval by Engineer after Contract Award.
- .2      Confirm finishes prior to ordering.

**PART 2      Products**

Section Item	Color	Remarks
Division 4 - Masonry		
Division 6 - Wood and Plastics		
Division 7 - Thermal and Moisture Protection		
Division 8 - Doors and Windows		
Division 9 - Finishes		
Painting		
Division 10 - Specialties		
Division 11 - Equipment		
Equipment		
Acoustic Panels	Genon W5-26-ZZ 'Super White'	"Decoustic panels"
Division 12 - Furnishings		
Division 15 - Mechanical		

**PART 3      Execution**

.1      Not Used.

END OF SECTION

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**PART 1      General**

**1.1          SAMPLES**

- .1      Submit duplicate 300 x 400 sample piece of panel complete with vinyl cover finish in accordance with Section 013300 – Submittal Procedures.

**1.2          MAINTENANCE**

- .1      Provide maintenance data for decoustic wall panels for incorporation into maintenance manual specified in Section 017000 – Closeout Submittals.

**PART 2      Products**

**2.1          MATERIALS**

- .1      Ceiling panels: to be decoustics acoustical panel type H1R1 28.6 mm thick at (7 lb/cu. ft) 112 kg/cu. m rigid fiberglass core plus 3.2 mm thick high density fiberglass laminate. No substitution.
- .2      Type H1R1 core shall be AP core as specified. The skin shall be smooth with no defects. The finish thickness shall not vary from panel to panel by more than .5 mm.
- .3      Each panel shall have an integral frame consisting of a chemically hardened edge to a depth of 3.2 mm with a barcol hardness of 35, panels shall be dimensionally stable and not warped.
- .4      All panels shall be manufactured from exact field dimensions provided by Contractor to a tolerance of +(0.020”) 0.5 mm. Face of all panels shall be mechanically sanded after sizing to ensure best possible surface is attained prior to vinyl application.
- .5      Vinyl shall be Decoustic S2000, vinyl colour to be selected by Engineer, perforated to achieve optimum acoustical performance and bonded to panel, wrinkle free surface and heat sealed to manufacturer’s specification.
- .6      Panels shall have a minimum acoustical performance in accordance with ASTM C426 on modified ‘A’ mounting.
- .7      All accessories, leveling clips, wall clips, leveling angles and all ceiling accessories shall be supplied by decoustic manufacturer.
- .8      Decoustic panel:
  - .1      Acceptable Products
    - .1      NICO Distributors, Edmonton, Alberta, Tel: (403) 436-4623
    - .2      VBG: Distributors (Vern Gudmundson), Winnipeg, Manitoba, Tel: (204) 668 1596,

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**PART 3 Execution**

**3.1 INSPECTION**

- .1 Ensure ceiling surface is flat and true and dust free.
- .2 Maintain temperature between 15 degrees Celsius to 30 degrees Celsius with relative humidity not exceeding 70%.
- .3 Installing Contractor shall have at least 5 years experience in their class of work with skilled tradesmen.

**3.2 Ceiling Installation**

- .1 Ceiling installation use System C: to hard ceiling areas. Panels are provided with integral panel clips along all edges. Panels over 600 have intermediate panel clips and track. Refer to manufacturer ceiling installation procedure.
- .2 Install panels around ceiling mounted lighting and services.

**3.3 Cleaning**

- .1 Panels shall be spot cleaned to remove any finger marks or soil.

END OF SECTION

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**PART 1      General**

**1.1            REFERENCES**

- .1      Architectural Painting Specifications Manual, Master Painters Institute (MPI).
- .2      Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).
- .3      Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).
- .4      National Fire Code of Canada.

**1.2            QUALITY ASSURANCE**

- .1      Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2      Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3      Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4      Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .5      Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.
- .6      Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Engineer.
- .7      Standard of Acceptance:
  - .1      Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

**1.3            SCHEDULING OF WORK**

- .1      Submit work schedule for various stages of painting to Engineer for approval. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2      Obtain written authorization from Engineer for any changes in work schedule.

- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

#### **1.4 SUBMITTALS**

- .1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 013300 - Submittal Procedures.
- .2 Submit WHMIS MSDS.- Material Safety Data Sheets in accordance with Section 026133 - Hazardous Materials.
- .3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
  - .1 Product name, type and use.
  - .2 Manufacturer's product number.
  - .3 Colour number[s].
  - .4 MPI Environmentally Friendly classification system rating.
  - .5 Manufacturer's Material Safety Data Sheets (MSDS).

#### **1.5 SAMPLES**

- .1 Submit full range colour sample chips in accordance with Section 013300 - Submittal Procedures. Indicate where colour availability is restricted.
- .2 Submit 200 x 300 mm sample panels of each paint, stain, clear coating, and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
  - .1 3 mm plate steel for finishes over metal surfaces.
  - .2 13 mm birch plywood for finishes over wood surfaces.
  - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
  - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
  - .5 10 mm plywood for finishes over wood surfaces.
- .3 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

#### **1.6 QUALITY CONTROL**

- .1 Provide mock-up in accordance with Section 014500 - Quality Control.
- .2 When requested by Engineer, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

#### **1.7 EXTRA MATERIALS**

- .1 Submit maintenance materials in accordance with Section 017800 - Closeout Submittals.



- .2 Submit one - four litre can of each type and colour of primer, stain, and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
- .3 Deliver to Contractor and store where directed.

## **1.8 DELIVERY, HANDLING AND STORAGE**

- .1 Deliver, store and handle materials in accordance with Section 016100 - Common Product Requirements.
- .2 Labels shall clearly indicate:
  - .1 Manufacturer's name and address.
  - .2 Type of paint or coating.
  - .3 Compliance with applicable standard.
  - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Provide and maintain dry, temperature controlled, secure storage.
- .5 Observe manufacturer's recommendations for storage and handling.
- .6 Store materials and supplies away from heat generating devices.
- .7 Store materials and equipment in a well ventilated area with temperature range 7 to 30 degrees Celsius.
- .8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Engineer. After completion of operations, return areas to clean condition to approval of Engineer.
- .10 Remove paint materials from storage only in quantities required for same day use.
- .11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .12 Fire Safety Requirements:
  - .1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
  - .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

## **1.9 SITE REQUIREMENTS**

- .1 Temperature, Humidity and Substrate Moisture Content Levels:
  - .1 Unless specifically pre-approved by the specifying body, and the applied product manufacturer, perform no painting work when:

- .1 Ambient air and substrate temperatures are below 10 degrees Celsius.
- .2 Substrate temperature is over 32 degrees Celsius unless paint is specifically formulated for application at high temperatures.
- .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
- .4 The relative humidity is above 85% or when the dew point is less than 3 degrees Celsius variance between the air/surface temperature.
- .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
- .2 Perform no painting work when the maximum moisture content of the substrate exceeds:
  - .1 [12]% for concrete and masonry (clay and concrete brick/block).
  - .2 [15]% for wood.
  - .3 [12]% for plaster and gypsum board.
- .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".
- .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .2 Surface and Environmental Conditions:
  - .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
  - .3 Apply paint only when previous coat of paint is dry or adequately cured.
  - .4 Provide minimum lighting level of 270Lux is provided on surfaces to be painted.

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

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal.
- .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .5 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .6 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

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**PART 2      Products**

**2.1            MATERIALS**

- .1      Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2      Paint materials for paint systems shall be products of a single manufacturer.
- .3      Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall possess the following characteristics:
  - .1      low Volatile Organic Compound (VOC) in accordance with Section 014718 – Indoor Air Quality Management
  - .2      be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
  - .3      be manufactured without compounds which contribute to smog in the lower atmosphere.
  - .4      do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .4      Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising there from, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

**2.2            COLOURS**

- .1      Colour Schedule: Section 090600 –Schedules for Finishes.

**2.3            MIXING AND TINTING**

- .1      Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Engineer's written permission.
- .2      Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3      Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
- .4      Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Engineer.
- .5      Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

**2.4            GLOSS/SHEEN RATINGS**

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

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Gloss Level Category	Units @ 60°	Units @ 85°
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

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

## 2.5 PAINTING SYSTEMS

- .1 Plywood wall and ceiling finishes
- .1 INT 4.2D High performance architectural latex [eggshell gloss] finish.
  - .2 INT 4.2F Epoxy (tile-like) finish [for dry environments].
  - .3 INT 4.2J Waterborne epoxy (tile-like) finish [for dry environments].
- .2 Galvanized Metal: doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.
- .1 INT 5.3M High performance architectural latex [eggshell gloss] finish.
- .3 Dressed Lumber: including doors, door and window frames, casings, mouldings, etc.
- .1 INT 6.3A High performance architectural latex [semi gloss level] finish.
  - .2 INT 6.3C Semi-transparent stain finish [do not use on doors].
  - .3 INT 6.3D Alkyd varnish [semi-gloss level] finish (over stain).
- .4 Wood Paneling and Casework: partitions, panels, shelving, millwork, etc.
- .1 INT 6.4C Semi-transparent stain finish.
  - .2 INT 6.4D Alkyd varnish [semi-gloss] finish (over stain).
  - .3 Epoxy coating
- .5 Plaster and Gypsum Board: gypsum wallboard, drywall, "sheet rock type material", etc., and textured finishes
- .1 INT 9.2B High performance architectural latex [insert gloss level] finish.
  - .2 INT 9.2E Epoxy (tile-like) finish.
  - .3 INT 9.2F Waterborne epoxy (tile-like) finish.

## PART 3 Execution

### 3.1 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

### **3.2 EXISTING CONDITIONS**

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Engineer damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Engineer. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
  - .1 Wood: [15]%.

### **3.3 PROTECTION**

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Engineer.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Engineer.

### **3.4 CLEANING AND PREPARATION**

- .1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
  - .1 Remove dust, dirt, and other surface debris by vacuuming, and/or wiping with dry, clean cloths.
  - .2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
  - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
  - .4 Allow surfaces to drain completely and allow to dry thoroughly.
  - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

- .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
- .2 Apply wood filler to nail holes and cracks.
- .3 Tint filler to match stains for stained woodwork.
- .4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, and vacuum cleaning.
- .6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

### 3.5 APPLICATION

- .1 Method of application to be as approved by Engineer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
  - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
  - .2 Work paint into cracks, crevices and corners.
  - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
  - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Engineer.
  - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application:
  - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
  - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
  - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
  - .4 Brush out immediately all runs and sags.
  - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.
- .5 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .9 Finish closets and alcoves as specified for adjoining rooms.
- .10 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

### **3.6 MECHANICAL/ELECTRICAL EQUIPMENT**

- .1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .9 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .10 Do not paint interior transformers and substation equipment.

### **3.7 RESTORATION**

- .1 Clean and re-install all hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Engineer. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Engineer.

END OF SECTION



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**Part 1            General**

**1.1                REFERENCES**

- .1     ASTM D523-08 - Test Method for Specular Gloss.
- .2     ASTM D1730-03 - Standard Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting.
- .3     ASTM D5861-07 - Standard Guide for Significance of Particle Size Measurements of Coating Powders.
- .4     PCI (Powder Coating Institute): Powder coatings on metal substrate.
- .5     SSPC (The Society for Protective Coatings):
  - .1     SSPC SP5 - White Metal Blast Cleaning.
  - .2     SSPC SP7 - Brush-Off Blast Cleaning.
  - .3     SSPC SP10 - Near-White Blast Cleaning.

**1.2                PERFORMANCE REQUIREMENTS**

- .1     Powder Utilization: Minimum 95 percent.
- .2     Salt Spray Resistance: No blistering, wrinkling, or loss of adhesion, when tested to ASTM B117, at the following exposure durations:
  - .1     Steel surfaces: Not less than 500 hours.
  - .2     Other surfaces: Not less than 250 hours.

**1.3                SUBMITTALS FOR REVIEW**

- .1     Section 01 33 00: Submission procedures.
- .2     Product Data: Submit full records of all products used. List each product in relation to finish formula and include the following:
  - .1     Product type and use.
  - .2     Manufacturer's product number.
  - .3     Colour numbers - Pantone
  - .4     Manufacturer's Material Safety Data Sheets (MSDS).
- .3     Samples: Submit two (2), 300 x 200 mm sample panels, of minimum 14 gauge thick sheet steel, for each finish colour specified.

**1.4                SUBMITTALS FOR INFORMATION**

- .1     Section 01 33 00: Submission procedures.
- .1     Installation Data: Manufacturer's special installation requirements.
- .2     Sustainable Design:

- .1 Section 01 47 13: Sustainable requirements.
- .2 Provide required LEED documentation for Product recycled content, regional materials, and low-emitting materials.
- .3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements

## **1.5 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 10: Submission procedures.
- .2 Sustainable Design Closeout Documentation

## **1.6 QUALITY ASSURANCE**

- .1 Standard of Acceptance:
  - .1 Final coat to exhibit uniformity of color and uniformity of gloss across full surface area.
  - .2 Quality of coated products to conform to specified requirements.

## **1.7 DELIVERY, STORAGE, AND PROTECTION**

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Deliver and store materials in original packaging, sealed, with labels intact.
- .3 Indicate on containers or wrappings:
  - .1 Manufacturer's name and address.
  - .2 Type of coating.
  - .3 Colour number in accordance with established color schedule.
- .4 Maintain dry, temperature controlled, secure storage.

## **1.8 ENVIRONMENTAL REQUIREMENTS**

- .1 Section 01 35 43: Environmental conditions affecting products on site.
- .2 Maintain substrate and ambient temperature limits required by coating manufacturer.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Thermosetting Powder:
  - .1 Material: Acrylic-urethane.
  - .2 Thickness to ASTM D5861:
    - .1 Exterior or wet surfaces: 4 to 6 mils dry film thickness.
    - .2 Interior or dry surfaces: 1 to 3 mils dry film thickness.
  - .3 Finish: As scheduled.
- .2 Pre-treatment materials:

- .1 Steel surfaces: Iron phosphate.
- .2 Galvanized or steel structures: Zinc phosphate.
- .3 Aluminum surfaces: Chrome-phosphate.

## **2.2 SURFACE FINISH**

- .1 Colour: As scheduled.
- .2 Surface Gloss: 25 to 35 - smooth matte to ASTM D523.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Grind fabrication welds smooth.
- .2 Clean surfaces to be coated as follows:
  - .1 Remove all dust, dirt, and other surface debris by vacuuming, wiping with dry with clean cloths or compressed air.
  - .2 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
  - .3 Allow surfaces to drain completely and allow to thoroughly dry.
- .3 If the above procedures do not clean the substrate surfaces, clean the surfaces with high pressure water washing.
- .4 Surfaces to Receive Finishes: Completely dry and free of debris, oils, dust, or other materials.
- .5 Substrate Pre-treatment:
  - .1 Apply pretreatment as soon as possible after cleaning and before surface deterioration occurs.
  - .2 Aluminum surfaces: Pre-treat to ASTM D1730 Type B, Method 5 using a multi-stage chromate process or a pretreatment process approved by powder coating manufacturer.
  - .3 Stainless steel surfaces: Pre-treat to SSPC SP7. Test surface using copper sulphate to ensure all pacification is removed.
  - .4 Galvanized steel surfaces: Pre-treat to ASTM D1730.
  - .5 Steel, exterior: Pre-treat to SSPC SP10.
  - .6 Non-ferrous interior surfaces: Pre-treat with minimum 3-stage multi-metal phosphate.
  - .7 Non-ferrous exterior surfaces: Pre-treat with SSPC SP7.
  - .8 Other Ferrous surfaces: Pre-treat surfaces with mil scale to SSPC SP10, surfaces without mil scale with 3-stage wash.

### **3.2 APPLICATION**

- .1 Apply coating to requirements of coating manufacturer's written application instructions.

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- .2 Provide uniform, smooth, even cured coating, free of runs, sags, and streaks.
  - .3 Provide and maintain equipment that is suitable for intended purpose, capable of properly fluidizing powder coating.
  - .4 Apply coating to coating manufacturer's recommended minimum dry film thickness.
  - .5 Ensure coating adheres to internal corners and recessed areas.
  - .6 Cure in accordance with manufacturer's cure curves. Allow surfaces to cure for minimum time period as required by manufacturer.
  - .7 Touch up damaged powder coating with suitable paint.
  - .8 Prime coat finished powder coating surfaces intended to receive adhesives or tape.
  - .9 Provide powder recovery equipment to maintain minimum required powder utilization rate.

**3.3 PROTECTION OF FINISHED WORK**

- .1 Protect elements surrounding the work of this Section from damage or disfiguration.

**3.4 SCHEDULE**

- .1 Front metal canopy
- .2 Metal handrails and guardrails
- .3 Access ladders

**END OF SECTION**

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**PART 1      General**

**1.1            REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM A167-[99], Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM B456-[95], Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - .3 ASTM A653/A653M-[99], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .4 ASTM A924/A924M-[99], Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.88-[92], Gloss Alkyd Enamel, Air Drying and Baking.
  - .2 CAN/CGSB-12.5-[M86], Mirrors, Silvered.
- .3 Canadian Standards Association (CSA)
  - .1 CAN/CSA-B651-[95], Barrier-Free Design.
  - .2 CAN/CSA-G164-[M92], Hot Dip Galvanizing of Irregularly Shaped Articles.

**1.2            SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
- .2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

**1.3            SAMPLES**

- .1 Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2 Samples to be returned for inclusion into work.

**1.4            CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 017800 - Closeout Submittals.

**1.5            WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 017421 – Construction Waste Management and Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

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**1.6 EXTRA MATERIALS**

- .1 Provide 2 of each type of special tool required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 017800 - Closeout Submittals.
- .2 Deliver special tools to Engineer.

**PART 2 Products**

**2.1 MATERIALS**

- .1 Sheet steel: to ASTM A653/A653M with [ZF001] designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A167, Type 304, with satin finish.
- .3 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness, except where specified otherwise.
- .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

**2.2 COMPONENTS**

- .1 Toilet tissue dispensers (TTD): double roll type, surface mounted, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.
- .2 Combination towel dispenser/waste receptacles (TD/WR): semi-recessed wall units, approximately 380 mm wide, 1180 mm high, 135 mm deep. Interior of 0.75 mm galvanized steel, exterior of 0.8 mm stainless steel, AISI Type 302, No. 4 finish. Suitable for dispensing folded or roll paper towels. Removable galvanized steel waste receptacle, lockable access door with continuous full height stainless steel hinge.
- .3 Soap dispensers (SD): liquid push-in valve, self-contained 1.14 L tank, stainless steel piston and valve assembly, surface mounted, exposed metal components chrome plated.
- .4 Mirrors (MR): 6 mm mirror quality float glass, 610 mm x 1220 mm, including concealed fasteners, with 13 x 13 x 13 mm stainless steel channel frames. Include stainless steel shelf + 127 mm wide with 10 mm deep edges on 3 sides and rounded exterior corners. Bottom edge 1000 a.f.f.
- .5 Clothes hooks (RH): auto-release. One inside door of Public Washroom 102; one inside door of Guard Washroom 130 @ 1400 a.f.f.
  - .1 Acceptable product: Watrous Model W123.
- .6 Mop Strip. One in each Janitor room.
  - .1 Acceptable product: Bobrick B-239
- .7 Shower curtains:
  - .1 Include nylon hooks and 1500 x 1500 vinyl weave shower curtain.

.2 Provide curtain hold-back hook and chain at each curtain.

.8 Plastic surface mounted hand towel dispensers (HD): suitable for roll or folded towels. (One in Guard Washroom 130, one in Breath Test Room 138). Public Washroom 103.

## **2.3 FABRICATION**

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

## **2.4 FINISHES**

.1 Chrome and nickel plating: to ASTM B456, satin finish.

.2 Baked enamel: condition metal by applying one coat of metal conditioner to CGSB 31-GP-107Ma, apply one coat Type 2 primer to CAN/CGSB-1.81 and bake, apply two coats Type 2 enamel to CAN/CGSB-1.88 and bake to hard, durable finish. Sand between final coats. Colour selected from standard range by Engineer.

.3 Manufacturer's or brand names on face of units not acceptable.

## **PART 3 Execution**

### **3.1 INSTALLATION**

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.

.3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.

- 
- .4 Toilet/shower compartments: use male/female through bolts.
  - .2 Install grab bars on built-in anchors provided by bar manufacturer.
  - .3 Use tamper proof screws/bolts for fasteners.
  - .4 Fill units with necessary supplies shortly before final acceptance of building.
  - .5 Install mirrors in accordance with Section 088050 - Glazing.

**3.2**

**SCHEDULE**

- .1 Locate accessories where indicated. Exact locations determined by Engineer.
- .2 Toilet tissue dispenser: one in each toilet compartment, not in cells
- .3 Soap dispenser: one at each single wash basin or one per two wash basins in multiple locations.

END OF SECTION



**PART 1      General**

**1.1            REFERENCES**

- .1      CAN/CGSB-44.40-[92], Steel Clothing Locker.

**1.2            SHOP DRAWINGS**

- .1      Submit shop drawings in accordance with Section 013300 - Submittal Procedures.
- .2      Indicate type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, tops, rods, hooks, shelves, bases, trim, numbering, filler panels, end/back panels, doors, handles, locking method, ventilation method and finishes.

**1.3            SAMPLES**

- .1      Submit samples in accordance with Section 013300 - Submittal Procedures.
- .2      Submit duplicate 50 x 50 mm samples of colour and finish on actual base metal.

**PART 2      Products**

**2.1            MANUFACTURED UNITS**

- .1      Gun Storage Locker: to CAN/CGSB-44.40
  - .1      Size: minimum 5" x 10" opening
  - .2      Keying: Cylindrical locks, keyed individually and master keyed
  - .3      Steel Thickness:
    - .1      Door: minimum 16 ga
    - .2      Body: minimum 20ga
  - .4      Acceptable Products:
    - .1      DSM Law Enforcement Products
    - .2      Canadian Locker Company
    - .3      Folger Adam Detention Products
    - .4      Southern Steel Detention Products

**PART 3      Execution**

**3.1            INSTALLATION**

- .1      Assemble and install lockers in accordance with manufacturer's written instructions.
- .2      Securely fasten lockers to grounds and nailing strips.
- .3      Install wall trim around recessed locker banks.

- .4 Install filler panels (false fronts) where indicated and where obstructions occur.
- .5 Install finished end and back panels to exposed ends and backs of locker banks.
- .6 Install locker numbers and locks.

**3.2 SCHEDULE**

- .1 As indicated on drawings.

END OF SECTION

**Part 1            General**

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

- .1 Submit 1 copy of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
- .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets 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 Transfer information daily to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 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 in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative 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.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

## **1.2 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

## **1.3 MAINTENANCE**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One head gasket set for each heat exchanger.

- .4 One glass for each gauge glass.
- .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

**Part 2 Products**

Not Used.

**Part 3 Execution**

**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 20 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

**3.2 CLEANING**

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

**3.3 FIELD QUALITY CONTROL**

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

**3.4 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
  - .1 HVAC Systems:

- .1 Furnace units
- .2 Air Conditioning
- .3 Exhaust fans
- .2 Plumbing Systems
  - .1 Plumbing fixtures
  - .2 Remote Fixture operation systems
  - .3 Water heating systems
  - .4 Water storage/pressurization
  - .5 Sewage holding
- .3 Fire Protection Systems
  - .1 Wet pipe sprinkler system
  - .2 Fire extinguishers
- .4 Controls Systems
  - .1 EMCS building HVAC control and monitoring system
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative will record these demonstrations on video tape for future reference.

**3.5 PROTECTION**

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

END OF SECTION

**Part 1      General**

**1.1      INTENT**

- .1      This Section specifies commissioning requirements common to all Division 21, 22, 23, and 25 equipment and systems starting and testing, Component Verifications and Systems Performance Verification Testing.
- .2      The Contractor shall expedite required revisions identified during the testing and verification in a cooperative manner to maintain the construction schedule.

**1.2      WORK INCLUDED**

- .1      General inspection and component verification of all mechanical equipment.
- .2      Specific equipment and system performance testing as specified herein or in other sections of the specifications.
- .3      Co-ordination with other trades and testing agencies including local Authority having Jurisdiction.
- .4      Instruction for the Owner's staff in the cleaning, maintenance and operation of the building systems, equipment and finishes.

**1.3      OVERVIEW**

- .1      The commissioning process follows a logical sequence, from Contractor equipment startup and testing to Component Verifications through to System Performance Verification Testing and finally Integrated System Testing.
- .2      At completion of the commissioning process, all defined system components, each mode of systems operation, and each control sequence will have been started and tested in accordance with the Manufacturer's requirements and verified operational relative to design intent and operational requirements.
- .3      Equipment and System Starting and Testing:
  - .1      Complete equipment starting and testing procedures as defined in the respective Sections of this specification.
  - .2      All starting, testing, adjusting, balancing and calibration activities are to be documented by the Contractor.
  - .3      All Contractor and Manufacturer startups and testing procedures are to be completed and approved prior to conducting the System Performance Verification Testing defined herein.
  - .4      The Contractor will be responsible for identifying in the commissioning schedule, the required equipment starting and testing, including all Manufacturer's startup and field verifications.
  - .5      Perform and record pressure testing on all piping and ducting systems installed under this Contract.

- .4      Component verification sheets shall be developed by this Contractor for each piece of equipment specified and installed. The Contractor shall be responsible for completion of these sheets.
  
- .5      System Performance Verification Testing:
  - .1      The System Performance Verification Tests provide a functional demonstration of the system performance during the various modes of operation including, startup, operation, shut down and various disturbance situations such as power failure and fire alarm.
  - .2      The System Performance Verification Tests shall be developed by the Contractor.
  - .3      All Contractor and Manufacturer's startup and proving tests are to be completed and approved prior to conducting the defined System Performance Verification Tests.
  - .4      All Component Verifications and identified testing pre-requisites related to a given system, shall be completed and approved prior to conducting the defined System Performance Verification Testing.
  - .5      The Contractor will be responsible for the scheduling and implementation of the System Performance Verification Testing.
  
- .6      The commissioning process associated with the component and systems verifications does not negate the need for the normal contractor equipment and system startup and proving and the associated training requirements.

#### **1.4      RELATED REQUIREMENTS**

- .1      Equipment startup and testing procedures, including Manufacturer startups, specified in this and other Sections.

#### **1.5      EQUIPMENT STARTING AND TESTING**

- .1      Prior to starting and testing, ensure all equipment is cleaned and free of dust.
- .2      After testing, protect equipment from dust.
- .3      Do not conceal or cover components or equipment until inspected, tested and approved by the Commissioning Contractor.
- .4      Assume all liabilities associated with the starting and testing.
- .5      Assume all costs associated with the starting, testing, adjusting and balancing, including the supply of testing equipment.

#### **1.6      WITNESSING OF EQUIPMENT STARTING AND TESTING**

- .1      Prior to starting and testing of equipment and systems, prepare a schedule for the required starting and testing.



## **1.7            MANUFACTURER’S STARTING RECOMMENDATIONS**

- .1      Prior to starting components or systems, obtain and review manufacturer’s installation, operation and starting instructions. Read in conjunction with the procedures specified herein.
- .2      Use manufacturer’s and supplier’s starting personnel where required to maintain validity of manufacturer’s warranty. Confirm with manufacturer that all testing specified in these specifications will not void any warranties.
- .3      Compare installation to manufacturer’s published data and record discrepancies. Modify procedures detrimental to components performance prior to starting equipment.

## **1.8            CO-ORDINATION**

- .1      Co-ordinate all sub-trades, other divisions, manufacturers, suppliers and other specialists as required to ensure all phases of work shall be properly organized prior to commencement of each particular startup, testing and commissioning procedure.
- .2      Where any components or systems require testing prior to starting, ensure that such work has been completed and approved prior to starting of the components and systems.

## **Part 2            Products**

- .1      Provide all instruments, meters, and equipment required to conduct tests during and at the conclusion of the project.

## **Part 3            Execution**

### **3.1            EQUIPMENT STARTING AND TESTING**

- .1      Schedule and complete the equipment startup, run-ins and testing as defined in the respective Sections.
- .2      Submit all startup and test reports, including Manufacturer’s reports.
- .3      All startup and testing is to be done in accordance with approved Manufacturer’s procedures.

### **3.2            COMPONENT VERIFICATIONS**

- .1      Complete Component Verifications in accordance with this Section.
- .2      In addition to the starting and testing requirements identified for each piece of equipment, as defined in the respective Sections, the Component Verifications sheets identified in this Section are to be complete by the Contractor.
- .3      The Component Verification sheets are used to track individual pieces of equipment and provide a ‘Submittal Verification’ and a ‘Field Verification’ of equipment.

The 'Submittal Verification' includes verifying and confirming the specified requirements against the shop drawing submittal data and the 'Field Verification' includes confirming that the installed parameters meet the specified requirements.

- .4 The Component Verification sheets shall be completed as follows:
  - .1 The 'Specified' fields on the sheet shall be completed by the Engineer.
  - .2 The 'Shop Drawing' fields on the sheets shall be completed by the Contractor.
  - .3 The 'Installed' fields on the sheets shall be completed by the Contractor.
- .5 A Component Verification sheet is to be completed for each specified piece of equipment.

### **3.3 EQUIPMENT START-UP AND OPERATIONAL TESTING**

- .1 EMCS
  - .1 General
    - .1 Review documentation to ensure all system components and operation are recorded in detail.
    - .2 Check installation for orderly component and conduit mounting with all portions secured to building structure. Ensure installations of EMCS do not impede access to building spaces or equipment.
    - .3 Check installations in secure areas are hidden or covered and secured in an acceptable manner.
  - .2 Furnace/Air Conditioning
    - .1 Check EMCS installations are secured to building or equipment and do not impede access.
    - .2 Check stroke of all dampers.
    - .3 Check installation of all devices to ensure correct location/orientation.
    - .4 Check operation of all devices for limits and operating points.
    - .5 Check manual overrides for operation.
    - .6 Simulate component failure to check reaction of remaining components and systems.
- .2 FIRE PROTECTION
  - .1 Wet Pipe Sprinkler System
    - .1 Perform regulatory testing as required by specifications, Codes and Authority Having Jurisdiction.
    - .2 Check sprinkler head mounting in secure areas.
    - .3 Check all sprinkler head guards in place and firmly attached.
    - .4 Assist in Fire Alarm verification.
  - .2 Fire Extinguishers
    - .1 Check all fire extinguishers in place according to Drawings.
    - .2 Check all fire extinguishers firmly mounted in place.
    - .3 Check all fire extinguishers carry current certification tag signed and dated.

- .3 PLUMBING SYSTEMS
  - .1 Plumbing Fixtures
    - .1 All
      - .1 Check fixtures firmly attached to supporting surfaces.
      - .2 Operate local water isolation valves, ensure full shut off of water flow.
      - .3 Operate fixture, check hot/cold flows, general performance, measure water flow on representative quantity of each fixture type.
    - .2 Secure Fixtures
      - .1 Check for exposed operable fasteners.
      - .2 Check for openings, cracks, crevices in fixture construction or mounting.
      - .3 Operate metered valves, adjust flow duration.
  - .2 Water Heater System
    - .1 Check temperature set point against actual measured temperature.
    - .2 Operate safety controls.
    - .3 Operate drain valves.
  - .3 Piping Systems
    - .1 Perform regulatory testing as required by specifications, Codes and Authority Having Jurisdiction.
    - .2 Operate all zone isolation valves.
    - .3 Check flow settings at all circuit balance locations.
  - .4 Miscellaneous Systems
    - .1 Check operation of water tempering valves. Review and record temperatures at full flow.
- .4 HEATING SYSTEMS
  - .1 Furnaces
    - .1 Perform regulatory testing as required by specifications, Codes and Authority Having Jurisdiction.
    - .2 Check air temperature rise through furnaces at maximum fire and design flow.
    - .3 Check operation of all safety and operating controls.
  - .2 Heating Terminal Devices
    - .1 Secure Areas
      - .1 Check for exposed operable fasteners.
      - .2 Check for openings, cracks, crevices in radiant panel and forceflow mounting.
- .5 VENTILATION SYSTEMS
  - .1 Exhaust Systems
    - .1 Verify fan rotation direction.
    - .2 Monitor operation of fans for abnormal vibration.
    - .3 Check operation of all motorized dampers for extent of opening, shut off and smooth non-binding operation.
  - .2 Duct Systems
    - .1 Check duct sealing.
    - .2 Check duct identification.
    - .3 Check all manual balance dampers are secured and marked at balance point.
    - .4 Check mounting of all grilles registers and diffusers.

- .5      Secure Area Ventilation Grilles.
  - .1      Check for exposed operable fasteners.
  - .2      Check for openings, cracks, crevices in installations or mounting.

**3.4            PRESSURE TESTING OF PIPING**

- .1      Test all piping prior to concealment and completion of system.
- .2      Record test results by section. Records to be included in Operation and Maintenance Manuals. Show section designation on As-Built Record Drawings.
- .3      Test as noted below. For systems not included below, refer to appropriate specification section. Notify Engineer where test requirement is not shown. Include for testing all piping to minimum of 690 kPa hydrostatic for minimum 1 hour unless lower pressure is warranted.

System	Media (Note 1)	Pressure (Note 2)	Duration
<b>Plumbing</b>			
- DCW, DHW	Water	690 kPa	4 hr
- Nat Gas or Propane Gas (Note 3)	Air	340 kPa	3 hr
- San Sewer/Vent (Note 4, 5)	Water	3 m w.c.	30 min

Note 1	Where possibility of freezing exists, compressed air may be substituted with written permission of the Engineer
Note 2	Pressure test to 1.5 times operating pressure of system. Minimum test pressure is shown. Protect or remove all components which may be damaged by test pressure.
Note 3	Test as required by: Gas Code
Note 4	Test as required by: Plumbing Code
Note 5	Test water closet installations with 25 mm W.C. for 15 min after fixture has been set.

END OF SECTION

**SYSTEM PERFORMANCE VERIFICATION FORM**

.1 AIR MOVING EQUIPMENT

Date: \_\_\_\_\_

Equipment ID: \_\_\_\_\_  
 Equipment Data: \_\_\_\_\_ Location Data: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_ Building: \_\_\_\_\_  
 Model Number: \_\_\_\_\_ Area: \_\_\_\_\_  
 Serial Number: \_\_\_\_\_ Floor: \_\_\_\_\_  
 Room: \_\_\_\_\_

Operation

		Specified	Shop Drawings	Installed	Verified By:
Airflow Rate	Supply				
	Return				
External Static Pressure	Supply				
	Return				
Volts/Amps/Phase	Supply				
	Return				
Rotation Direction	Supply				
	Return				

Inspection Check List:

Filters

- Size
- Quantity
- Baffles
- Clean Filter

Coils

Size  x  x       Size  x

FFI

Rows

Fin Condition

Dampers

Size  x

Seals

Operation – close

                          – open

Belts

- Size
- Quantity
- Tensioned
- Alignment

Operating Controls

- Start /Stop from \_\_\_\_\_
- Test  \_\_\_\_\_

- Clean External
- Clean Internal
- Not Damaged
- Service Space
- Lubricated
- Product \_\_\_\_\_

Comments


Sign Off

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Engineer

\_\_\_\_\_  
Owner

Sample

**SYSTEM PERFORMANCE VERIFICATION FORM**

.2      PUMP VERIFICATION FORM

Date: \_\_\_\_\_

Equipment ID: \_\_\_\_\_

Equipment Data:	_____	Location Data	_____
Manufacturer:	_____	Building:	_____
Model Number:	_____	Area:	_____
Serial Number:	_____	Floor:	_____
		Room:	_____

Operation:

	Specified	Shop Drawings	Installed	Verified By
Flow Rate				
Head				
Fluid				
Fluid Temperature				
Volts / Amps/ Phase				
Rotation Direction				

Operating Controls:  
 Start / Stop From \_\_\_\_\_  
 Test:  \_\_\_\_\_

Comments


Sample

Sign Off

\_\_\_\_\_  
 Contractor

\_\_\_\_\_  
 Engineer

\_\_\_\_\_  
 Owner

**SYSTEM PERFORMANCE VERIFICATION FORM**

.3 FAN VERIFICATION FORM

Date: \_\_\_\_\_

Equipment ID \_\_\_\_\_  
 Equipment Data: \_\_\_\_\_ Location Data \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_ Building: \_\_\_\_\_  
 Model Number: \_\_\_\_\_ Area: \_\_\_\_\_  
 Serial Number: \_\_\_\_\_ Floor: \_\_\_\_\_  
 Room: \_\_\_\_\_

Operation

		Specified	Shop Drawings	Installed	Verified By:
Airflow Rate	Supply				
	Return				
External Static Pressure	Supply				
	Return				
Volts/Amps/Phase	Supply				
	Return				
Rotation Direction	Supply				
	Return				

Inspection Check List:

Belts:

- Size \_\_\_\_\_ Clean
- Quantity  Not Damaged
- Tensioned  Service Space
- Alignment  Lubricated:
- Product

Dampers:

- Size  x
- Seals
- Operation – Close
- - Open

Operating Controls:

Start / Stop From \_\_\_\_\_  
 Test:

Comments


Sign Off

\_\_\_\_\_  
 Contractor                                      Engineer                                      Owner



**Part 1      General**

**1.1      SUBMITTALS**

- .1      Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Saskatchewan, Canada.
- .3      Submit complete plans to Authority of Jurisdiction for review and approval before commencement of work.
- .4      Shop drawings to show:
  - .1      Mounting arrangements.
  - .2      Operating and maintenance clearances.
- .5      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.
- .6      Closeout Submittals:
  - .1      Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .2      Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .3      Operation data to include:
    - .1      Control schematics for systems including.
    - .2      Description of systems and their controls.
    - .3      Description of operation of systems at levels.
    - .4      Operation instruction for systems and component.
    - .5      Description of actions to be taken in event of equipment failure.
    - .6      Valves schedule and flow diagram.
    - .7      Colour coding chart.
  - .4      Maintenance data to include:
    - .1      Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
    - .2      Data to include schedules of tasks, frequency, tools required and task time.
  - .5      Performance data to include:
    - .1      Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

- .2 Equipment performance verification test results.
- .3 Special performance data as specified.
- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
  - .1 Submit 1 copy of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets 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 Transfer information daily to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 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 in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative 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.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

## 1.2 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30- Health and Safety Requirements.

**1.3 MAINTENANCE**

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

**Part 2 Products**

**2.1 MATERIALS**

- .1 Section not used.

**Part 3 Execution**

**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 20 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

**3.2 CLEANING**

- .1 Clean all systems including heads and other equipment.

**3.3 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
  - .1 Fire extinguisher systems
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.

**3.4 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            REFERENCES**

- .1      American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
  - .1          ANSI/NFPA 13-1997, Installation of Sprinkler Systems.
- .2      Human Resources and Skills Development Canada – HRSDC
  - .1          FC403, Standard for Sprinkler Systems, November 1994 – Standards.
  - .2          Treasury Board Standards, Chapter 3-6.

**1.2            SHOP DRAWINGS AND PRODUCT DATA**

- .1      Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures and in accordance with ANSI/NFPA 13, working plans and design requirements.

**1.3            SAMPLES**

- .1      Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Submit samples of following:
  - .1          Each type of sprinkler head.
  - .2          Signs.

**1.4            ENGINEERING DESIGN CRITERIA**

- .1      Design system in accordance with ANSI/NFPA 13, using following parameters:
  - .1          Hazard:
    - .1              Light hazard.
  - .2          Pipe size and layout:
    - .1              Pipe schedule method.
    - .2              Sprinkler head layout: to ANSI/NFPA 13 and as directed by authorities having jurisdiction.
  - .3          Water supply:
    - .1              For future connection

**1.5            CLOSEOUT SUBMITTALS**

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

**1.6            EXTRA MATERIALS**

- .1      Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2      Provide spare sprinklers and tools as required by ANSI/NFPA 13. For secure area sprinkler heads only – increase quantities of spare heads to minimum of 30 of each type.

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**PART 2      Products**

**2.1            PIPE, FITTINGS AND VALVES**

- .1      Pipe:
  - .1      Ferrous: to ANSI/NFPA 13. All pipe shall be Schedule 40 wall thickness.
- .2      Fittings and joints to ANSI/NFPA 13:
  - .1      Ferrous: screwed, welded, flanged or roll grooved.
- .3      Valves:
  - .1      ULC listed for fire protection service.
  - .2      Up to NPS 2: bronze, screwed ends, OS & Y; gate, or ball type as permitted.
  - .3      NPS 2 1/2 and over: cast iron, flanged or roll grooved ends, indicating butterfly valve.
  - .4      Swing check valves.
  - .5      Ball drip.
- .4      Pipe hangers:
  - .1      ULC listed for fire protection services.

**2.2            SPRINKLER HEADS**

- .1      General: to ANSI/NFPA 13 and ULC listed for fire services.

**2.3            INSTITUTIONAL SECURE PENDANT HEAD – QUICK RESPONSE**

- .1      Acceptable material: Viking HQR-2.

**2.4            STANDARD - UPRIGHT**

- .1      Upright bronze, with or without guard as indicated.

**2.5            STANDARD – CONCEALED PENDANT**

- .1      Concealed pendant with coverplate – white.

**2.6            SIGNS**

- .1      Signs for design waterflow requirements: to ANSI/NFPA 13.

**2.7            SPARE PARTS CABINET**

- .1      For storage of maintenance materials, spare sprinkler heads and special tools.
- .2      Construct to sprinkler head manufacturer's standard.
- .3      Turn over spare heads in excess of those stored in cabinet to Departmental Representative. Record turnover with transmittal.

**PART 3      Execution**

**3.1            INSTALLATION**

- .1      Install, inspect and test to acceptance in accordance with ANSI/NFPA 13, FC 403 and other applicable standards.

END OF SECTION

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**Part 1            General**

**1.1                SHOP DRAWINGS AND PRODUCT DATA**

- .1            Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

**1.2                CLOSEOUT SUBMITTALS**

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

**Part 2            Products**

**2.1                MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS**

- .1            Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection. Sizes as indicated.
  - .1            Acceptable product: National Fire Protection ABC-10G, Pyrene, Flag.

**2.2                EXTINGUISHER BRACKETS**

- .1            Medium duty aviation bracket with strap and clamp.

**2.3                CABINETS**

- .1            Flush surface or semi-recessed type as indicated, constructed of 1.6 mm thick steel, 180° opening door of 2.5 mm thick steel with latching device.
- .2            Cabinet door: with 6 mm full plexiglass panel. All metal door latch.
- .3            Finish:
  - .1            Tub: prime coated.
  - .2            Door and frame: primer finish ready for final finish.
- .4            Acceptable product: National Fire Equipment CE-950-3, Pyrene, Flag.

**2.4                IDENTIFICATION**

- .1            Identify extinguishers in accordance with recommendations of ANSI/NFPA 10.
- .2            Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install or mount extinguishers in cabinets or on brackets as indicated.
- .2        Provide initial inspection signature and date on inspection tag.

END OF SECTION



**Part 1      General**

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

- .6 Approvals:
  - .1 Submit 1 copy of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets 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.
  - .2 Transfer information daily to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 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 in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative 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.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

## **1.2 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.3 MAINTENANCE**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.
  - .3 One glass for each gauge glass.

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

**Part 2 Products**

**2.1 MATERIALS**

- .1 Section not used.

**Part 3 Execution**

**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 20- Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

**3.2 CLEANING**

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

**3.3 FIELD QUALITY CONTROL**

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

**3.4 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
  - .1 Water heating systems.
  - .2 Secure fixture operators.
  - .3 Electronic fixture supplies.
  - .4 Water tempering systems.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

### **3.5 PROTECTION**

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

END OF SECTION

**PART 1      General**

**1.1            DEFINITIONS**

- .1      For purposes of this section:
  - .1          "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2          "EXPOSED" - will mean "not concealed" as defined herein.

**1.2            SHOP DRAWINGS**

- .1      Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

**1.3            SAMPLES**

- .1      Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

**1.4            MANUFACTURERS' INSTRUCTIONS**

- .1      Submit manufacturers' installation instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Installation instructions to include procedures to be used, installation standards to be achieved.

**1.5            QUALIFICATIONS**

- .1      Installer to be specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project.

**1.6            DELIVERY, STORAGE AND HANDLING**

- .1      Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2      Protect from weather, construction traffic.
- .3      Protect against damage from any source.
- .4      Store at temperatures and conditions required by manufacturer.

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**PART 2 Products**

**2.1 FIRE AND SMOKE RATING**

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

**2.2 INSULATION**

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: Rigid moulded mineral fiber without factory applied vapour retarder jacket (as scheduled in Part 3 of this section).
  - .1 Maximum 'k' value at 38°C mean temperature of 0.035 (SI).
  - .2 White kraft paper bonded to glass fiber reinforced aluminum foil.
- .4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket to CGSB 51-GP-52M (as scheduled in Part 3 of this section).
  - .1 Maximum 'k' value at 38°C mean temperature of 0.035 (SI).
  - .2 White kraft paper bonded to glass fiber reinforced aluminum foil.
- .5 TIAC Code A-6: Flexible unicellular tubular elastomer.
  - .1 Insulation: to ASTM C534..
  - .2 Maximum "k" factor: 0.27.
- .6 Acceptable Material: Knauf, Owens Corning, Johns Manville, Certain Teed, Armstrong.

**2.3 INSULATION SECUREMENT**

- .1 Tape: Self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

**2.4 CEMENT**

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

**2.5 VAPOUR RETARDER LAP ADHESIVE**

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

**2.6 INDOOR VAPOUR RETARDER FINISH**

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

**2.7 OUTDOOR VAPOUR RETARDER FINISH**

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

**2.8 JACKETS**

- .1 Polyvinyl Chloride (PVC):
  - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Colour: white.
  - .3 Minimum service temperatures: -20°C.
  - .4 Maximum service temperature: 65°C.
  - .5 Moisture vapour transmission: 0.02 perm.
  - .6 Thickness: 0.5 mm.
  - .7 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
- .2 Canvas:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .2 Lagging adhesive: Compatible with insulation.
- .3 Aluminum:
  - .1 To ASTM B209.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: Stucco embossed.
  - .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
  - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

- .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

## **2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS**

- .1 Caulking to: Section 07 92 10 - Joint Sealers.

## **PART 3 Execution**

### **3.1 PRE- INSTALLATION REQUIREMENT**

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

### **3.2 INSTALLATION**

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

### **3.3 INSTALLATION OF ELASTOMERIC INSULATION**

- .1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

### **3.4 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
  - .1 Securements: SS Wire Bands Tape at 300 mm oc.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.



- .1 Securements: SS Wire at 300 mm oc.
- .2 Seals: VR lap seal adhesive, VR lagging adhesive.
- .3 Installation: TIAC Code: 1501-C.
  
- .4 TIAC Code: A-6.
  - .1 Insulation securements: as listed by Manufacturer..
  - .2 Seals: lap seal adhesive, lagging adhesive.
  
- .5 Thickness of insulation to be as listed in following table.
  - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
  - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic HWS		A-1	25	25	25	38	38	38
Domestic CWS		A-3	25	25	25	25	25	25
Sanitary Sewer Vent (See Note 1)		A-3				25	25	
Natural Gas or Propane Gas (See Note 2)								
Note 1	Insulate sanitary sewer vent piping from cold air terminus continuously through cold interior building areas and to 2 m into warm building area.							
Note 2	Coat all natural gas piping penetrating exterior wall or roof for 2 m into building with 2 heavy coats of brush on vapour retardent mastic. Permeance value less than 0.05, flame spread less than 20.							

- .6 Finishes:
  - .1 Exposed indoors: Canvas, Aluminum or PVC jacket.
  - .2 Exposed in mechanical rooms: Canvas, Aluminum or PVC jacket.
  - .3 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
  - .4 Outdoors: Water-proof Aluminum jacket.
  - .5 Finish attachments: SS bands, at 150 mm oc. Seals: wing.
  - .6 Installation: To appropriate TIAC code CRF/1 through CPF/5.

END OF SECTION

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**PART 1      General**

**1.1            PRODUCT DATA**

- .1      Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Submit data for following: valves.

**1.2            CLOSEOUT SUBMITTALS**

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

**PART 2      Products**

**2.1            PIPING**

- .1      Domestic hot, cold, tempered and recirculation systems, within building.
  - .1      Above ground: copper tube, hard drawn, type K: to ASTM B88.

**2.2            FITTINGS**

- .1      Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.
- .2      Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3      Cast copper, solder type: to ANSI/ASME B16.18.
- .4      Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5      NPS2.5 and larger: roll grooved to CSA B242.

**2.3            JOINTS**

- .1      Rubber gaskets, 1.6 mm thick: to ANSI/AWWA C111/A21.11.
- .2      Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3      Solder: 95/5 tin copper alloy.
- .4      Teflon tape: for threaded joints.
- .5      Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

**2.4            SWING CHECK VALVES**

- .1      NPS 2 and under, soldered:
  - .1      To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 20 10 07 Mechanical - General Valves - Bronze.
  - .2      Acceptable material: Crane, Toyo, MAS.

- .2 NPS2 and under, screwed:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 20 10 07 - Valves - Bronze.
  - .2 Acceptable material: Crane, Toyo, MAS.

## **2.5 BALL VALVES**

- .1 NPS2 and under, screwed:
  - .1 Class 150.
  - .2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle as specified Section 20 10 07 Mechanical- General Valves - Bronze.
  - .3 Acceptable material: Crane, Toyo, MAS.
- .2 NPS2 and under, soldered:
  - .1 To ANSI/ASME B16.18, Class 150.
  - .2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle, with NPT to copper adaptors as specified Section 20 10 07 Mechanical- General Valves - Bronze..
  - .3 Acceptable material: Crane, Toyo, MAS.

## **2.6 CIRCUIT BALANCE VALVES**

- .1 Supply and install where shown, calibrated, testable, y-pattern circuit balance valves. Each valve shall be equipped with test ports for field connection of a portable differential pressure test meter.
- .2 Valves shall have micrometer adjustable flow setting scale with positive position memory. Valves shall be capable of use for positive shut off.
- .3 Valves shall be constructed of copper alloy suitable for use in potable water systems.
- .4 Acceptable material: Victaulic T&A, Armstrong, Taco.

## **PART 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Assemble piping using fittings manufactured to ANSI standards.
- .3 Install CWS piping away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

### **3.2 VALVES**

- .1 Isolate equipment, fixtures and branches with butterfly or ball valves.
- .2 Balance recirculation system using circuit balance valves. Mark settings and record on as-built drawings on completion.

### **3.3 PRESSURE TESTS**

- .1 Conform to requirements of Section 20 05 00 Mechanical- General Requirements.
- .2 Test pressure: greater of 1 1/2 times maximum system operating pressure or 860 kPa.

### **3.4 FLUSHING AND CLEANING**

- .1 Flush entire system for 2 h.

### **3.5 PRE-START-UP INSPECTIONS**

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

### **3.6 PERFORMANCE VERIFICATION (PV)**

- .1 Timing:
  - .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
- .2 Procedures:
  - .1 Verify that flow rate and pressure meet Design Criteria.
  - .2 TAB HWC in accordance with Section 23 05 93 HVAC - Testing Adjusting and Balancing (TAB).
  - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
  - .4 Verify performance of temperature controls.
  - .5 Verify compliance with safety and health requirements.
  - .6 Check for proper operation of water hammer arrestors. Run each outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor. Repeat for outlets and flush valves.

END OF SECTION

**Part 1 General**

**1.1 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Drawings to indicate:
  - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
  - .2 Wiring and schematic diagrams.
  - .3 Dimensions and recommended installation.
  - .4 Pump performance and efficiency curves.

**1.2 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Data to include:
  - .1 Manufacturers name, type, model year, capacity and serial number.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list with names and addresses.

**Part 2 Products**

**2.1 DOMESTIC WATER PRESSURE SYSTEM**

- .1 Pump
  - .1 Variable speed, variable capacity domestic water pressurization pump suitable for continuous operation. Pump shall be certified for use with potable water.
  - .2 Stainless steel casing, discharge head, discharge check, bowl, shaft and trim. Bearings, seats and seals shall be certified for contact with potable water.
  - .3 Pump mount bracket to support pump inside water storage tank. Support height max 50 mm height.
  - .4 Capacity as scheduled on drawing.
  - .5 Acceptable products: ITT Goulds 10GS
- .2 Controller
  - .1 Constant pressure controller shall sense system water pressure and provide variable signal to control pump speed to maintain constant (adjustable) pressure in system.
  - .2 NEMA 1 indoor enclosure.
  - .3 Soft start to prevent water hammer.
  - .4 UL and cUL listed.
  - .5 Built in diagnostics and protection for surge protection, underload, undervoltage, locked pump, open circuit, short circuit and overheated controller.

- .6 External pressure sensor.
- .7 Capacity to match pump.
- .8 Acceptable products: Franklin Electric MonoDrive
- .3 Storage Tanks
  - .1 Natural white UV resistant, polyethylene shall be certified food safe and acceptable for storage of potable water.
  - .2 Provide welded connection, bulkhead fittings and access openings with covers as required.
  - .3 Acceptable products: QMP

### **Part 3 Execution**

#### **3.1 INSTALLATION**

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

#### **3.2 FIELD QUALITY CONTROL**

- .1 Check power supply.
- .2 Check protective devices.
- .3 Start-up, check for proper and safe operation.

#### **3.3 START-UP**

- .1 General:
  - .1 In accordance with Section 01 91 13 - Commissioning Requirements, supplemented as specified herein.
  - .2 Procedures:
    - .1 Check power supply.
    - .2 Start pumps, check impeller rotation.
    - .3 Check for safe and proper operation.
    - .4 Check settings and operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

#### **3.4 REPORTS**

- .1 In accordance with Section 21 05 02 – Testing and Commissioning of Mechanical Systems supplemented as specified herein.
- .2 Include
  - .1 PV results on approved PV Report Forms.
  - .2 Product Information report forms.

- .3 Pump performance curves (family of curves) with final point of actual performance marked thereon.

**3.5 TRAINING**

- .1 In accordance with Section 01 91 13 - Commissioning, supplemented as specified herein.

**END OF SECTION**

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**PART 1      General**

**1.1            WASTE MANAGEMENT AND DISPOSAL**

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

**PART 2      Products**

**2.1            PIPING AND FITTINGS**

- .1      DWV piping to:
  - .1      CSA-B181.2.
  - .2      Do not use standard PVC-DWV for sections of piping located in a space used for movement of return air. Pipe and fittings shall be formulated for flame spread of 0 and Smoke Developed of 35. No field applied coatings will be acceptable except where used to recoat piping joints.
    - .1      Acceptable product: IPEX XFR

**2.2            JOINTS**

- .1      Solvent weld for PVC: to ASTM D2564.
- .2      Transition couplings. To be completed.

**PART 3      Execution**

**3.1            INSTALLATION**

- .1      Install in accordance with Canadian Plumbing Code an local authority having jurisdiction.
- .2      Where pipe or fittings are located within a space to be used for transport of return air, provide treated system to meet Flame Spread of 0 and Smoke Developed of 35 when tested to CAN/ULC S102.2. Only field joints may be coated in field. Provide all pipe and fittings of factory treated material. Install according to Manufacturers certified procedures, using compatible solvent cement and primer.

**3.2            TESTING**

- .1      Hydraulically test to verify grades and freedom from obstructions.

**3.3            PERFORMANCE VERIFICATION (PV)**

- .1      Cleanouts:
  - .1      Ensure accessible and that access doors are correctly located.
  - .2      Open, cover with linseed oil and re-seal.
  - .3      Verify cleanout rods can probe as far as the next cleanout, at least.



- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 2.4 m (whichever is less).

END OF SECTION

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**Part 1            General**

**1.1                REFERENCES**

- .1    Canadian Standards Association (CSA)
  - .1    CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
  - .2    CAN/CSA-C309, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

**1.2                SHOP DRAWINGS**

- .1    Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures .
- .2    Indicate:
  - .1    Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

**1.3                CLOSEOUT SUBMITTALS**

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

**1.4                WARRANTY**

- .1    For the Work of this Section 22 34 00 - Domestic Water Heaters, the 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to three years for tank, combustion chamber and flue.

**Part 2            Products**

**2.1                ELECTRIC WATER HEATER**

- .1    Glass lined storage tank with 25 mm foam insulation cover clad in enamelled steel outer cover.
- .2    Fully automatic control with adjustable temperature settings.
- .3    Single, screw-in style element.
- .4    Dielectric water connection fittings.
- .5    Protective magnesium anode rod.
- .6    Temperature and pressure relief valve.
- .7    Tank shall be suitable for wall mounting and shall be complete with heavy duty wall mounting bracket.
- .8    Capacity as scheduled.
- .9    Acceptable product: Bradford White

**2.2 TRIM AND INSTRUMENTATION**

- .1 Drain valve: NPS  $\frac{3}{4}$  with hose end.
- .2 Thermometer: Dial type with red pointer and thermowell filled with conductive paste to requirements of Section 23 05 19.
- .3 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
- .4 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

**END OF SECTION**

**PART 1      General**

**1.1      SHOP DRAWINGS**

- .1      Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Indicate, for all fixtures and trim:
  - .1      Dimensions, construction details and materials, roughing-in dimensions, performance.

**1.2      CLOSEOUT SUBMITTALS**

- .1      Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.
- .2      Include:
  - .1      Description of fixtures and trim, giving manufacturer's name, type, model, capacity.
  - .2      Details of operation, servicing and maintenance.
  - .3      List of recommended spare parts.

**PART 2      Products**

**2.1      MANUFACTURED UNITS**

- .1      Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2      Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3      Exposed plumbing brass to be chrome plated.
- .4      Number, locations: Architectural drawings to govern. Quantities shown on Mechanical drawings may not be reduced.
- .5      Fixtures in any one location to be product of one manufacturer and of same type.
- .6      Trim in any one location to be product of one manufacturer and of same type.
- .7      Sinks
  - .1      S-1: Standard type, single compartment, stainless steel
    - .1      Fixture: Single compartment with faucet ledge, 18 ga. Type 304 18-10 stainless steel. Self rimming. Bowl dimensions: 280 mm (f/b) x 330 mm (w) x 200 mm (deep). Drilled to match faucet.

- .1 Acceptable product: Kindred LBS 1308P-1
- .2 Faucet: Heavy duty cast brass with polished chrome plating. Two handle, 200 mm centres with 200 mm tubular spout, vandal resistant aerator (5.7 L/min) and 75 mm lever handles. Ceramic cartridges.
  - .1 Acceptable product: Delta Commercial 26C3233
- .3 Trim: Basket strainer drain fitting with cast brass trap complete with union nut connection and clean out.
- .2 S-2: Standard type, Janitor mop sink, single compartment, floor type.
  - .1 Fixture: Single compartment floor mounted janitor mop sink of pressure molded plastic complete with stainless steel drain body. Bowl dimensions: 610 mm (f/b) x 914 mm (w) x 254 mm (deep). Fixture shall be complete with flat stainless steel strainer, vinyl bumper guard on exposed edges and stainless steel wall guard on wall sides. 610 mm wall mount mop bracket.
    - .1 Acceptable product: Fiat MSB-3624, 889-CC, E-77-AA, 1453 B8, MSG 3624.
  - .2 Faucet: Heavy duty cast brass with rough chrome finish. Two handle, 200 mm centres, pail hook, inline vacuum breaker, hose-end spout and wall brace. Include heavy duty 1200 mm long hose c/w hanger bracket.
    - .1 Acceptable product: Delta Commercial 28T9, 28T911
- .8 Lavatory Basins
  - .1 L-1: Standard type,
    - .1 Fixture: Vitreous china wall hung-white. Ledge back with front overflow. Drilled for 100 mm centres faucet and concealed arm carrier. Bowl dimensions: ~250 mm (f/b) x ~400 mm (w) x ~150 mm (deep).
      - .1 Acceptable product: American Standard 0355 012 Lucuvne.
    - .2 Faucet: Heavy duty cast brass with polished chrome plate. Two handle, 100 mm centres, vandal resistant aerator (5.7L/min) aerator and 100 mm blade handles. Ceramic cartridges.
      - .1 Acceptable product: Delta Commercial 21C144.
    - .3 Carrier: Concealed arm, floor supported carrier with steel uprights c/w welded feet, cast iron adjustable headers, concealed arms with fixtures locking devices and alignment truss. Note that top of upright shall be fastened into wall structure.
      - .1 Acceptable product: Zurn Z1231.

- 
- .4 Trim: Chrome plated brass trap with union nut cleanout.
  - .9 Water Closets
    - .1 WC-1: Secure type, combi water closet/lavatory basin, angle type
      - .1 Fixture: Suicide resistant comby water closet/basin. Hemispherical cabinet manufactured of 14 gauge, type 304 stainless steel with all welded joints ground smooth and polished to satin finish. D shaped lavatory bowl. Water closet bowl shall be elongated with self draining flushing rim and integral contoured seat. Orient bowl as shown on drawings. Fixture shall be mounted on floor with wall outlet. Integral traps. Flush volume: 1.6 GPF. Hemispherical penal bubbler on basin.
        - .1 Acceptable product: Acorn 1440-A(L/R) – 2 – BPH – MCVI – MVCFV (1.6) – PBH – TF.
        - .2 Faucet/Flush Valve: Remote operated/timed operation flush vavle and faucet controls. Flush valve shall operate as a timed solenoid with lock out of operation adjustable from 1 to 9 minutes. Operation shall be from remote pneumatic push button mounted in secure area as shown. Provide lamacoid function label. Faucet shall operate as timed flow solenoid valve with adjustable with adjustable duration of 1 second to 9 minutes. Operation shall be from individual remote pneumatic push buttons moutned in secure area as shown. Provide lamacoid function labels. Provide 110 VAC / 24 VAC transformer for power supply. Extend pneumatic tubes to 15 m each.
          - .1 Acceptable product: Acorn MVCF-MVCFV, MVC2
        - .3 Water tempering valve: Each hot supply shall be equipped with a point of use thermostatic tempering valve. Tempering vavle to bronze body with stainless steel piston and wax filled thermostat. Valve to include check valves on inlets. Minimum flow 2.0 L/min.
          - .1 Acceptable product: Bradley S59-4008
      - .2 WC-2: Standard Type, Flush tank, Floor mounted.
        - .1 Fixture: White vitreous china elongated bowl flush tank water closet. Siphon action with 75 mm flush valve and 6.0 Lpf operation. Fully galzed 54 mm trapway with 50 mm ball pass. 420 mm high rim with 225 mm x 200 mm water surface.

Tank shall be lined and have bolted cover. Provide stainless steel strap and rear bumper to secure tank to wall.

          - .1 Acceptable product: American Standard 3016 001 bowl with 4021 700 tank modified with strap and bumper.
        - .2 Seat: White heavy duty plastic open front less cover for elongated bowl. Stainless steel hinge posts, pintels and hardware. Stainless steel fastners.

- .1 Acceptable product: Bemis 1055
- .10 Shower
  - .1 SH-1: Secure type
    - .1 Enclosure: Refer to Architectural
    - .2 Shower valve: Remote operated/timed duration valve controller. Duration controller shall be actuated by a pneumatic push button located as shown on drawings. Duration shall be selectable from 1 second to 9 minutes. Provide 110 VAC/24 VAC transformer for power supply.
      - .1 Acceptable product: Acorn 1743-MVC1-F-TF
    - .3 Shower Head: Vandal resistant anti-suicide penal shower head with concealed adjustment spray pattern.
      - .1 Acceptable product: Acorn Penal Head
    - .4 Thermostatic Mixing Valve: Bronze body and cap with stainless steel piston and liner with wax filled thermostat motor. Valve shall be equipped with inlet check stops, dial thermometer and 18 gauge surface mounted cabinet. Minimum flow capacity 2 Lpm.
      - .1 Acceptable product: Bradley S59-2007-T-SE.
- .11 Fixture Piping
  - .1 Water supplies
    - .1 Chrome plated flexible copper supply pipes with screw driver ball valve style stops and chrome escutcheons.
  - .2 Waste
    - .1 Chrome plated brass p-trap with cleanout with chrome escutcheon.

**PART 3 Execution**

**3.1 INSTALLATION**

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

**3.2 ADJUSTING**

- .1 Conform to water use requirements specified in this section.
- .2 Adjustments
  - .1 Adjust water flow rate to design flow rates.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks
  - .1 Aerators: operation, cleanliness.
  - .2 Vacuum breakers, backflow preventers: operation under all conditions.
  - .3 Wash fountains: operation of flow-actuating devices.
  - .4 Review all secure fixtures to confirm no exposed non-secure fasteners or gaps or open seams.
- .4 Thermostatic controls
  - .1 Verify temperature settings, operation of control, limit and safety controls.

**3.3 ELECTRONIC HARD-WIRED**

- .1 Provide acceptable transformer to Electrical Division. Transformer shall be rated for connected load requirements.
- .2 Equipment manufacturer shall provide complete wiring diagrams for all installations.
- .3 Wiring shall be full concealed except where intended by manufacturer to be exposed. Where exposed, wiring shall be routed along building lines, close to finishes, away from normal sight lines. Conceal exposed wiring in supplementary flexible conduit.
- .4 Wiring and accessories shall be of quality and execution as specified in electrical divisions.
- .5 Control / mixing enclosures are to be mounted below floor exposed in the Service Space. Provide extensions for the sensor wiring and water supply pipes as required.

END OF SECTION



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**PART 1      General**

**1.1      SUBMITTALS**

- .1      Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      For shop drawings, indicate dimensions, construction details and materials.
- .3      For product data, indicate dimensions, construction details and materials for items specified herein.

**1.2      CLOSEOUT SUBMITTALS**

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

**PART 2      Products**

**2.1      FLOOR DRAINS**

- .1      Floor drains: to CSA B79.
- .2      Type FD-1: secure duty; cast iron collar round with galvanized steel flange for wood floor mounting, fixed head, heavy duty stainless steel strainer with maximum 6 mm openings and secure type fasteners, integral seepage pan and PVC outlet. Fasteners to be stainless steel Torx with pin style.
  - .1      Acceptable material: Mifab F1230-WF-3-6-30-HP
- .3      Type FD-2: as specified for type FD-1 except will be used with H x S elbow for horizontal outlet.
- .4      Type FD-3: general duty; cast iron collar round with galvanized steel flange for wood floor mounting, heavy stainless steel strainer, integral seepage pan and PVC outlet.
  - .1      Acceptable material: MiFab F1230-WF-3-30
- .5      Type FFD-1: general duty funnel drain; cast iron collar round with galvanized steel flange for wood floor mounting, heavy duty nickel bronze strainer with 4" round funnel, integral seepage pan and PVC outlet.
  - .1      Acceptable material: Mifab F1230-WF-1-30-F4

## **2.2 CLEANOUTS**

- .1 Access covers:
  - .1 Floor access: round cast iron body and frame with secured heavy duty nickel bronze top and with body as specified for Type FD-1 Floor drain and solid gasketed top.:
    - .1 Plugs: bolted bronze with neoprene gasket.
    - .2 Cover for all floor types: nickel bronze heavy duty round 12mm thick scoriated cover, gasket, vandal-proof screws.
      - .1 Acceptable material: Mifab F1230-WF + C1100-RC.

## **2.3 WASHING MACHINE CONNECTION BOX ‘HB-1’**

- .1 Box consisting of white ABS plastic enclosure and finish face plate with molded connection openings.
- .2 Water supplies with quarter turn ball valves and hose thread outlets. Each supply shall be equipped with a water hammer arrestor sized for residential washing machine use.
- .3 50 mm hub drain connection.
- .4 Acceptable product: Sioux Chief 696-2313MF, Oatey

## **2.4 PLUMBING VENT TERMINATION**

- .1 Electrically heated, insulated device specifically manufactured to prevent freezing of plumbing vent terminations.
- .2 Heat trace shall be self regulating with ground fault equipment protection, plug-in and switch.
- .3 Acceptable product: Arctic Vent.

## **2.5 BACK FLOW PREVENTERS**

- .1 All backflow prevention device installations shall conform to the requirements of CANCSA-B61.10-94 ‘Manual for the Selection, Installation, Maintenance, and Field Testing of Backflow Prevention Devices’.
- .2 Double Check Valve Assemble (DCVA)
  - .1 DCVA shall consist of two internally loaded check valves, two ball type isolation valves and one y-strainer.
  - .2 Unit shall be constructed with bronze body, stainless steel springs and fasteners with replaceable resilient rubber seats and top mounted test cocks.
  - .3 Provide top access for maintenance and repair.
  - .4 Maximum working pressure: 175 psig.
  - .5 Temperature range: 33°F – 180°F.
  - .6 Acceptable material: Conbraco 40-11x-T2, Watts, Wilkins.
  - .7 Acceptable material: Conbraco 40-21x-T2 w/ 40-200-Xx air gap drain, Watts, Wilkins.

## **2.6 THERMAL EXPANSION TANKS**

- .1 Steel pressure tank with baked on epoxy coating, butyl diaphragm. Pre-charged, adjustable in field. Approved for potable water service.
- .2 Tank capacity: To be completed.
- .3 Expansion capacity:
- .4 Acceptable Product:

## **2.7 HOSE BIBBS AND SEDIMENT FAUCETS**

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

## **2.8 ROOF FLASHINGS**

- .1 Spun aluminum (single piece construction) with EPDM triple grommet seal to pipe at top and EPDM base seal at underside. Lined with urethane insulation pre-molded to inside surfaces.
- .2 Sized for exact fit on penetrating pipe.

## **2.9 THERMOSTATIC MIXING VALVES**

- .1 Thermostatic mixing valve shall be of bronze construction with stainless steel flow control components. Removable cartridge with strainer, stainless steel piston, liquid filled thermal motor with bellows mounted out of water complete with inlet check stops.
- .2 Mixing valve shall be provided as an assembly complete with volume control shut-off valve, bimetal mixed water temperature gauge with 75 mm diameter face, brass pipe, fittings, unions with wall mounting bracket, all factory assembled and tested.
- .3 Control range 29°C to 49°C, minimum temperature differential adjustable to within 5.6°C of inlet temperature. Maximum working pressure of 860 kPa. Minimum flow rate of 1.9 litre/minute, maximum of 143.8 litres/minute with 69 kPa pressure drop.
- .4 Valve to fail safe on loss of flow to reduced water supply.
- .5 Acceptable material: Symmons 5-500 A-ASB-W, Powers, Leonard.

## **2.10 SANITARY SEWER HOLDING SYSTEM**

- .1 Tank shall be custom manufactured for receiving and storage of sanitary sewer for transportable unit as shown on drawing.
- .2 Maximum dimensions shall be: 3350 mm (long) x 2135 mm (wide) x 350 mm (deep). Minimum stored volume shall be 2300 L.

- .3 Tank to be manufactured of polyethylene specifically for holding sanitary sewage. Provide inlet/outlet bulkhead connections as required for all services. Connectors shall be welded to tank. Provide tank vent connection and access opening complete with bolted, gasketted access door.
- .4 Reinforce tank as required at bottom and connection locations.
- .5 Acceptable product: Quality Molded Plastics Ltd. (QMP)

### **PART 3 Execution**

#### **3.1 INSTALLATION**

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

#### **3.2 CLEANOUTS**

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

#### **3.3 WATER HAMMER ARRESTORS**

- .1 Install on branch supplies to fixtures or group of fixtures where indicated.

#### **3.4 BACK FLOW PREVENTORS**

- .1 All backflow preventers shall be installed in readily accessible locations for testing and maintenance.
- .2 BFP's shall be installed level and oriented along building lines. All BFP's shall be installed within 1.5m above floor except where noted on drawing.
- .3 Upon completion of installation, retain services of Registered Testing Contractor to perform initial testing as set out in CAN/CSA-B64.10-94. Provide written test results prior to Substantial Performance.

#### **3.5 THERMAL EXPANSION TANKS**

- .1 Install tanks in horizontal or vertical up position. Do not install in vertical down orientation.
- .2 Support tank independently from structure.

### **3.6 HOSE BIBBS AND SEDIMENT FAUCETS**

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

### **3.7 SANITARY SEWER HOLDING SYSTEM**

- .1 Mount tank and make connections according to manufacturer's instructions.

### **3.8 WATER HEATER**

- .1 Mount tank and make connections according to manufacturer's instructions.

### **3.9 START-UP**

- .1 General:
  - .1 In accordance with Section 20 10 02 - Commissioning: General Requirements, supplemented as specified herein.
- .2 Timing: Start-up only after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
  - .4 Water treatment systems operational.
- .3 Provide continuous supervision during start-up.

### **3.10 TESTING AND ADJUSTING**

- .1 General:
  - .1 In accordance with Section 20 10 02 - Commissioning: General Requirements, supplemented as specified herein.
- .2 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:
  - .1 Flow rate at fixtures: +/- 10%.
- .4 Adjustments:
  - .1 Verify that flow rate and pressure meet design criteria.
  - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .5 Floor drains:
  - .1 Verify operation of trap seal primer.
  - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
  - .3 Check operations of flushing features.
  - .4 Check security, accessibility, removeability of strainer.

- .5 Clean out baskets.
- .6 Vacuum breakers, backflow preventers:
  - .1 Test tightness, accessibility for O&M of cover and of valve.
  - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
  - .3 Verify visibility of discharge from open ports.
- .7 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removeable.
- .8 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.
- .9 Commissioning Reports:
  - .1 In accordance with Section 20 10 02 - Commissioning: Reports, supplemented as specified herein.
- .10 Training:
  - .1 In accordance with Section 20 10 02 - Commissioning: Training of O&M Personnel, supplemented as specified herein.
  - .2 Demonstrate full compliance with Design Criteria.

### **3.11 ROOF FLASHINGS**

- .1 Install as recommended by Manufacturer.
- .2 Coordinate installation with roofing Contractor.
- .3 Provide pre-manufactured flashings for all pipe penetrations through roof including (but not limited to) plumbing vents and chilled water pipes. Install chilled water piping inside pipe material specified for sewer service. Terminate with 90° elbow and 45° elbow (directed downward) to provide weatherproof installation. Seal inner surfaces to refrigerant pipe insulation with expanding urethane foam.
- .4 Provide individual plumbing vents for fixture s located at each utility chase in secure areas (Do not pipe vents horizontally above inmate areas).

END OF SECTION

**Part 1      General**

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

- .1 Submit 1 copy of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
- .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets 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 Transfer information daily to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 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 in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative 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.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

## **1.2 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.3 MAINTENANCE**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
  - .1 One set of packing for each pump.
  - .2 One casing joint gasket for each size pump.



- .3 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Section not used.

**Part 3 Execution**

**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 20 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

**3.2 CLEANING**

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

**3.3 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
- .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 PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

**3.4 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

- .2 Trial usage to apply to following equipment and systems:
  - .1 HVAC Systems:
    - .1 Furnace Systems
    - .2 Exhaust Systems
  - .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
  - .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
  - .5 Instruction duration time requirements as specified in appropriate sections.

### **3.5 PROTECTION**

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

END OF SECTION

**Part 1           General**

**1.1           REFERENCES**

- .1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  - .1 ANSI/ASME B1.20.1-1983(R2001), Pipe Threads, General Purpose (Inch).
  - .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A276-04, Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  - .3 ASTM B283-99a, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  - .4 ASTM B505/B505M-02, Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  - .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2 MSS-SP-80-2003, Bronze Gate Globe, Angle and Check Valves.
  - .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

**1.2           SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Closeout Submittals:
  - .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.3           DELIVERY STORAGE AND DISPOSAL**

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

**Part 2           Products**

**2.1           MATERIALS**

- .1 Valves:
  - .1 Except for specialty valves, to be single manufacturer.
  - .2 All products to have CRN registration numbers.
- .2 End Connections:

- .1 Connection into adjacent piping/tubing:
  - .1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.
  - .2 Copper tube systems: Solder ends to ANSI/ASME B16.18.
- .3 Gate Valves:
  - .1 Requirements common to gate valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Bonnet: union with hexagonal shoulders.
    - .3 Connections: screwed with hexagonal shoulders.
    - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
    - .5 Packing: non-asbestos.
    - .6 Handwheel: non-ferrous.
    - .7 Handwheel Nut: bronze to ASTM B62.
  - .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
    - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
    - .2 Operator: Handwheel.
  - .3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
    - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
    - .2 Operator: Handwheel.
- .4 Globe Valves:
  - .1 Requirements common to globe valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Bonnet: union with hexagonal shoulders.
    - .3 Connections: screwed with hexagonal shoulders.
    - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
    - .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
    - .6 Handwheel: non-ferrous.
    - .7 Handwheel Nut: bronze to ASTM B62.
  - .2 NPS 2 and under, composition disc, Class 125:
    - .1 Body and bonnet: screwed bonnet.
    - .2 Disc and seat: renewable rotating PTFE disc, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
    - .3 Operator: Handwheel Lockshield.
  - .3 NPS 2 and under, composition disc, Class 150:
    - .1 Body and bonnet: union bonnet.
    - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
    - .3 Operator: Handwheel Lockshield.
- .5 Check Valves:

- .1 Requirements common to check valves, unless specified otherwise:
  - .1 Standard specification: MSS SP-80.
  - .2 Connections: screwed with hexagonal shoulders.
- .2 NPS 2 and under, swing type, bronze disc, Class 125:
  - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
  - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
- .3 NPS 2 and under, swing type, bronze disc:
  - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
  - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
- .6 Ball Valves:
  - .1 NPS 2 and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B62.
    - .2 Pressure rating: 4140-kPa CWP, 860 kPa steam.
    - .3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders, solder ends to ANSI.
    - .4 Stem: tamperproof ball drive.
    - .5 Stem packing nut: external to body.
    - .6 Ball and seat: replaceable hard chrome solid ball and teflon seats.
    - .7 Stem seal: TFE with external packing nut.
    - .8 Operator: removable lever handle.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

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

END OF SECTION

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**Part 1            General**

**1.1                REFERENCES**

- .1    American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  - .1        ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
- .2    American Society for Testing and Materials (ASTM).
  - .1        ASTM A49, Specification for Heat-Treated Carbon Steel Joint Bars.
  - .2        ASTM A126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - .3        ASTM B61, Specification for Steam or Valve Bronze Castings.
  - .4        ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .3    Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  - .1        SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
  - .2        SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - .3        SP-82, Valve Pressure Testing Methods.
  - .4        SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.
- .4    Underwriters Laboratories of Canada (ULC)
  - .1        ULC C-267-B.

**1.2                PRODUCT DATA**

- .1    Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Submit data for valves specified in this section.

**1.3                CLOSEOUT SUBMITTALS**

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

**Part 2            Products**

**2.1                GENERAL**

- .1    Except for specialty valves, to be of single manufacturer.
- .2    Standard specifications:
  - .1        Gate valves: MSS SP-70.
  - .2        Globe valves: MSS SP-85.
  - .3        Check valves: MSS SP-71.
- .3    Requirements common to valves, unless specified otherwise:

- .1 Body, bonnet: cast iron to ASTM B209 Class B.
- .2 Connections: flanged ends plain face to ANSI B16.1.
- .3 Inspection and pressure testing: to MSS SP-82.
- .4 Bonnet gasket: non-asbestos.
- .5 Stem: to have precision-machined Acme or 60°V threads, top screwed for handwheel nut.
- .6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
- .7 Gland packing: non-asbestos.
- .8 Handwheel: Die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49. Nut of bronze to ASTM B62.
- .9 Identification tag: with catalogue number, size, other pertinent data.
- .4 All products to have CRN registration numbers.
- .5 Operator: Handwheel.

## 2.2 GATE VALVES

- .1 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:
  - .1 Body and multiple-bolted bonnet: with full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125, WP = 860 kPa steam, 1.4 Mpa CWP.
  - .2 to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
  - .3 Seat rings: renewable bronze screwed into body.
  - .4 Stem: steel.
  - .5 Operator: Handwheel.

## 2.3 GLOBE VALVES

- .1 NPS 2 1/2 - 10, OSY:
  - .1 Body: with multiple-bolted bonnet.
  - .2 WP: 860 kPa steam, 1.4 MPa CWP.
  - .3 Bonnet-yoke gasket: non-asbestos.
  - .4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.
  - .5 Seat ring: renewable, regrindable bronze, screwed into body.
  - .6 Stem: bronze to ASTM B62.
  - .7 Operator: Handwheel.

## 2.4 VALVE OPERATORS

- .1 Install valve operators as follows:
  - .1 Handwheel: on valves except as specified.

- .2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in mechanical equipment rooms.

## **2.5 CHECK VALVES**

- .1 Swing check valves, Class 125:
  - .1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Flanged ends: plain faced with smooth finish.
    - .1 Up to NPS 10: cast iron to ASTM A126 Class B.
  - .2 Ratings:
    - .1 NPS 2 1/2 - 10: 860 kPa steam; 1.4 MPa CWP.
  - .3 Disc: Rotating for extended life.
    - .1 Up to NPS 6: bronze to ASTM B 62.
    - .2 NPS 8 and over: bronze-faced cast iron.
  - .4 Seat rings: renewable bronze to ASTM B62 screwed into body.
  - .5 Hinge pin, bushings: renewable bronze to ASTM B62.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install all valves in upright position with stem above horizontal.

**END OF SECTION**



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**Part 1            General**

**1.1                REFERENCES**

- .1    American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1    ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).
  - .2    ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
  - .3    ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings.
- .2    American Society for Testing and Materials (ASTM)
  - .1    ASTM A126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - .2    ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .3    Manufacturer's Standardization Society: for the Valves and Fittings Industry Inc. (MSS)
  - .1    MSS SP 67, Butterfly Valves.

**1.2                PRODUCT DATA**

- .1    Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Submit data for valves specified this section.

**1.3                CLOSEOUT SUBMITTALS**

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

**Part 2            Products**

**2.1                BUTTERFLY VALVES - RESILIENT SEAT - 200 PSIG**

- .1    Except for specialty valves, to be of single manufacturer.
- .2    To be suitable for dead-end service.
- .3    CRN registration number required for products.
- .4    Sizes: type: NPS 2 to 10.
- .5    Pressure rating for tight shut-off at temperatures up to maximum for seat material.
  - .1    NPS 2 - 10: 200 psig.
- .6    Minimum seat temperature ratings to 120°C.
- .7    Application: On-off operation.
- .8    Full lug body.

- .9 Operators:
  - .1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0° to 90°. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latchplate and mounting hardware: cadmium plated carbon steel. Standard coating: Black laquer.
- .10 Designed to comply with MSS SP-67 and API 609.
- .11 Compatible with ANSI Class 125/Class 150 flanges.
- .12 Construction:
  - .1 Body cast iron.
  - .2 Disc: ductile iron.
  - .3 Seat:
  - .4 Shaft: 416 stainless steel.
  - .5 Taper pin: 316 SS.
  - .6 Key: carbon steel.
  - .7 O-Ring: Buna-N.
  - .8 Bushings: Teflon.

## **2.2 MOUNTING FLANGES:**

- .1 Class 125 cast iron to ANSI B16.1 or Class 150 steel to B16.5 pipe flanges.

## **Part 3 Execution**

### **3.1 PREPARATION**

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

### **3.2 INSTALLATION OF VALVES**

- .1 Install in accordance with manufacturer's instructions.
- .2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
- .3 Verify suitability of valve for application by inspection of identification tag.
- .4 Mount actuator on to valve prior to installation.

- .5 Handle valve with care so as to prevent damage to disc and seat faces.
- .6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.
- .7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1    Canadian Gas Association (CGA)
  - .1        CSA/CGA B149.1-00, Natural Gas and Propane Installation Code.
- .2    Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
  - .2        CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3    National Fire Protection Association
  - .1        NFPA 13-1999, Installation of Sprinkler Systems.
  - .2        NFPA 14-2000, Standpipe and Systems.

**1.2                PRODUCT DATA**

- .1    Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product data to include paint colour chips, other products specified in this section.

**1.3                SAMPLES**

- .1    Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Samples to include nameplates, labels, tags, lists of proposed legends.

**Part 2            Products**

**2.1                MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1    Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2    Lettering and numbers to be raised or recessed.
- .3    Information to include, as appropriate:
  - .1        Equipment: Manufacturer's name, model, size, serial number, capacity.
  - .2        Motor: voltage, Hz, phase, power factor, duty, frame size.

**2.2                SYSTEM NAMEPLATES**

- .1    Colours:
  - .1        Hazardous: red letters, white background.

- .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
  - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

Size #	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20
  - .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
  - .1 Terminal cabinets, control panels: Use size #5.
  - .2 Equipment in Mechanical Rooms: Use size #9.
- .5 Identification for PWGSC Preventive Maintenance Support System (PMSS):
  - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
  - .2 Equipment in Mechanical Room:
    - .1 Main identifier: Size #9.
    - .2 Source and Destination identifiers: Size #6.
    - .3 Terminal cabinets, control panels: Size #5.
  - .3 Equipment elsewhere: Sizes as appropriate.

## 2.3 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
  - .1 Natural gas: to CSA/CGA B149.1.
  - .2 Sprinklers: to NFPA 13.

- .3 Standpipe and hose systems: to NFPA 14.

## 2.4 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .3 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
  - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
  - .3 Use double-headed arrows where flow is reversible.
- .4 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .5 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 All other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.
- .6 Colours and Legends:
  - .1 Where not listed, obtain direction from Engineer.
  - .2 Colours for legends, arrows: To following table:

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

.3	Contents	Background colour marking	Legend
	** Add design temperature		
	++ Add design temperature and pressure		
	Domestic hot water supply	Green	DOM. HW SUPPLY
	Dom. HWS recirculation	Green	DOM. HW CIRC
	Domestic cold water supply	Green	DOM. CWS
	Waste water	Green	WASTE WATER
	Sanitary	Green	SAN
	Plumbing vent	Green	SAN. VENT
	Refrigeration suction	Yellow	REF. SUCTION
	Refrigeration liquid	Yellow	REF. LIQUID
	Refrigeration hot gas	Yellow	REF. HOT GAS
	Natural gas or Propane Gas	to Codes	
	Fire protection water	Red	FIRE PROT. WTR
	Sprinklers	Red	SPRINKLER
	Conduit for low voltage control wiring	To Section 25 05 54	

## 2.5 IDENTIFICATION DUCTWORK SYSTEMS

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

## 2.6 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

## 2.7 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

- .2 Inscriptions to include function and (where appropriate) fail-safe position.

## **2.8 LANGUAGE**

- .1 Identification to be in English.

## **Part 3 Execution**

### **3.1 TIMING**

- .1 Provide identification only after all painting specified Section 09 91 20 - Painting has been completed.

### **3.2 INSTALLATION**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

### **3.3 NAMEPLATES**

- .1 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
  - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection
  - .1 Do not paint, insulate or cover in any way.

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

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.



- .8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification to be easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

### **3.5 VALVES, CONTROLLERS**

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S"hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Engineer. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

**END OF SECTION**

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**PART 1      General**

**1.1            GENERAL**

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

**1.2            QUALIFICATIONS OF TAB PERSONNEL**

- .1      Names of personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative within 90 days of award of contract.
- .2      Provide documentation confirming qualifications, successful experience.

**1.3            PURPOSE OF TAB**

- .1      Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2      Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3      Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

**1.4            EXCEPTIONS**

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

**1.5            CO-ORDINATION**

- .1      Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
- .2      Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

**1.6            PRE-TAB REVIEW**

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

## **1.7 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 22, 23 or 25.

## **1.8 OPERATION OF SYSTEMS DURING TAB**

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

## **1.9 START OF TAB**

- .1 Notify Departmental Representative 14 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
  - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .2 Application of weatherstripping, sealing, caulking.
  - .3 All pressure, leakage, other tests specified elsewhere Division 21, 22, 23 & 25.
  - .4 All provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
  - .1 Proper thermal overload protection in place for electrical equipment.
  - .2 Air systems:
    - .1 Filters in place, clean.
    - .2 Duct systems clean.
    - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
    - .4 Correct fan rotation.
    - .5 Fire and volume control dampers installed and open.
    - .6 Coil fins combed, clean.
    - .7 Access doors, installed, closed.
    - .8 Outlets installed, volume control dampers open.
  - .3 Liquid systems:
    - .1 Flushed, filled, vented.
    - .2 Correct pump rotation.
    - .3 Strainers in place, baskets clean.
    - .4 Isolating and balancing valves installed, open.
    - .5 Calibrated balancing valves installed, at factory settings.
    - .6 Chemical treatment systems complete, operational.

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**1.10 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus 5%, minus 5%.

**1.11 ACCURACY TOLERANCES**

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

**1.12 INSTRUMENTS**

- .1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

**1.13 SUBMITTALS**

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

**1.14 PRELIMINARY TAB REPORT**

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
  - .1 Details of instruments used.
  - .2 Details of TAB procedures employed.
  - .3 Calculations procedures.
  - .4 Summaries.

**1.15 TAB REPORT**

- .1 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .2 Submit 5 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

**1.16 VERIFICATION**

- .1 Reported results subject to verification by Departmental Representative.

- .2 Provide manpower and instrumentation to verify up to 15% of reported results.
- .3 Number and location of verified results to be at discretion of Departmental Representative.
- .4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

#### **1.17 SETTINGS**

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

#### **1.18 COMPLETION OF TAB**

- .1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.

#### **1.19 AIR SYSTEMS**

- .1 Standard: TAB to be to most stringent of this section, AABC or NEBB.
- .2 Do TAB of systems, equipment, components, controls specified in Division 22, 23 & 25.
- .3 Qualifications: personnel performing TAB to be qualified to standards of AABC or NEBB.
- .4 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .5 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
  - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
  - .2 At controllers, controlled device.
- .6 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).
- .7 Measure, adjust and commission outside air damper and return air damper in open position.

#### **1.20 DOMESTIC WATER SYSTEMS**

- .1 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of heaters, tank, pump, circulator, at controllers, controlled device.

- .2 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

**1.21 OTHER TAB REQUIREMENTS**

- .1 General requirements applicable to work specified this paragraph:
  - .1 Qualifications of TAB personnel: as for air systems specified this section.
  - .2 Quality assurance: as for air systems specified this section.

**PART 2 Products**

**2.1 NOT USED**

- .1 Not used.

**PART 3 Execution**

**3.1 NOT USED**

- .1 Not used.

END OF SECTION

**PART 1      General**

**1.1          DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as defined herein.
  - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

**1.2          SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

**1.3          SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

**1.4          MANUFACTURER'S INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

**1.5          QUALIFICATIONS**

- .1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project.

**1.6          DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

---

**PART 2      Products**

**2.1            FIRE AND SMOKE RATING**

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

**2.2            INSULATION**

- .1      Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2      Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C 335.
- .3      TIAC Code C-1: Rigid mineral fibre board to CAN/CGSB51.10, with factory applied vapour retarder jacket to CGSB 51-GP-52M (as scheduled in PART 3 of this Section).
  - .1      Maximum 'k' value at 38°C mean temperature of 0.035 (SI)
  - .2      Density of 48 kg/m<sup>3</sup> (3.0PCF)
  - .3      FSK facing
- .4      TIAC Code C-2: Mineral fibre blanket to CAN/CGSB-51.11 faced with factory applied vapour retarder jacket to CGSB 51-GP-52M (as scheduled in PART 3 of this section).
  - .1      Maximum 'k' value at 38°C mean temperature of 0.037 (SI)
  - .2      Density of 24 kg/m<sup>3</sup> (1.5 PCF)
  - .3      FSK facing
- .5      Acceptable Material: Knauf, Owens Corning, Johns Manville, Certain Teed.

**2.3            JACKETS**

- .1      Canvas:
  - .1      220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .2      Lagging adhesive: Compatible with insulation.



- .3 Aluminum:
  - .1 To ASTM B 209 as scheduled in PART 3 of this section.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: Stucco embossed..
  - .4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.
  - .5 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

## **2.4 ACCESSORIES**

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.
- .5 Outdoor Vapour Retarder Mastic:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.
- .6 Tape: self-adhesive, aluminum, reinforced, 50mm wide minimum.
- .7 Contact adhesive: quick-setting
- .8 Canvas adhesive: washable.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 19 mm wide, 0.5 mm thick stainless steel.

## **PART 3 Execution**

### **3.1 PRE-INSTALLATION REQUIREMENTS**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.

- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Supports, Hangers:
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: At 300 mm o/c in horizontal and vertical directions, minimum two rows each side.
- .7 Flexible blanket insulations shall be installed so that the installed thickness is no less than 75% of the listed thickness.

### 3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: Conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature air ducts	C-1	yes	25
Round cold and dual temperature air ducts	C-2	yes	38
Supply, return and exhaust ducts exposed in space being served	None	None	None
Outside air ducts to mixing plenum	C-1	yes	50
Mixing plenums	C-1	yes	50
Exhaust duct between dampers and louvres	C-1	yes	50
Outside air ducts (between outside air intake & furnace unit and through ceiling spaces)	C-2	yes	50

END OF SECTION

**PART 1      General**

**1.1            PRODUCT DATA**

- .1      Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Indicate on manufacturers catalogue literature following: valves.

**1.2            CLOSEOUT SUBMITTALS**

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

**PART 2      Products**

**2.1            PIPE**

- .1      Steel pipe: to ASTM A53, Schedule 40, seamless or ERW as follows:
  - .1      NPS 1/2 to 2, screwed.

**2.2            JOINING MATERIAL**

- .1      Screwed fittings: approved thread sealer compound.
- .2      Welded fittings: to CSA W47.1.

**2.3            FITTINGS**

- .1      Steel pipe fittings, screwed, flanged or welded:
  - .1      Malleable iron: screwed, banded, Class 150.
  - .2      Steel pipe flanges and flanged fittings: to ASME B16.5.
  - .3      Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
  - .4      Bolts and nuts: to ASME B18.2.1.
  - .5      Nipples: schedule 40, to ASTM A53/A53M.

**2.4            VALVES**

- .1      Provincial Code approved, lubricated ball type.

**PART 3      Execution**

**3.1            PIPING**

- .1      Install in accordance with Section 20 10 06 Mechanical- Pipework Installation, supplemented as specified herein.
- .2      Install in accordance with applicable Provincial/Territorial Codes.
- .3      Install in accordance with CAN/CGA B149.1.

- .4 Install drip points:
  - .1 At low points in piping system.
  - .2 At connections to equipment.
- .5 All piping installed for natural gas shall be sized large enough for the equivalent propane gas load.

### **3.2 VALVES**

- .1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

### **3.3 FIELD QUALITY CONTROL**

- .1 Test system in accordance with CAN/CGA B149.1 and requirements of authorities having jurisdiction.

### **3.4 PURGING**

- .1 Purge after pressure test in accordance with CAN/CGA B149.1.

### **3.5 PRE-START-UP INSPECTIONS**

- .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
- .2 Check gas trains, entire installation is approved by authority having jurisdiction.

### **3.6 CLEANING AND START-UP**

- .1 In accordance with requirements of CAN/CGA B149.1.

END OF SECTION

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**Part 1            General**

**1.1                REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.22, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
  - .2 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
  - .3 ASME B31.5, Refrigeration Piping.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM B280, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 Canadian Standards Association (CSA)
  - .1 CSA B52, Mechanical Refrigeration Code.
- .4 EPS 1/RA/1, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

**Part 2            Products**

**2.1                TUBING**

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
  - .1 Hard copper: to ASTM B280, type ACR.

**2.2                FITTINGS**

- .1 Service: design pressure 2070 kPa and temperature 121 deg C.
- .2 Brazed:
  - .1 Fittings: wrought copper to ASME B16.22.
  - .2 Joints: silver solder, 45% Ag - 15% Cu and non-corrosive flux.
- .3 Flared:
  - .1 Bronze or brass, for refrigeration, to ASME B16.26.

**2.3                PIPE SLEEVES**

- .1 Hard copper, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

**2.4                VALVES**

- .1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moistureproof seal for below freezing applications, brazed connections.

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**Part 3 Execution**

**3.1 GENERAL**

- .1 In accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein
- .2 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5.

**3.2 BRAZING PROCEDURES**

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

**3.3 PIPING INSTALLATION**

- .1 General:
  - .1 Hard drawn copper tubing: do not bend. Minimize use of fittings.
- .2 Hot gas lines:
  - .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
  - .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
  - .3 Provide inverted deep trap at top of risers.
  - .4 Provide double risers for compressors having capacity modulation.
    - .1 Large riser: install traps as specified above.
    - .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.
- .3 Provide refrigerant isolation valves on piping near condensing unit to allow removal of condensing unit without loss of refrigerant.

**3.4 PRESSURE AND LEAK TESTING**

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.
- .3 Test Procedure: Build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

**3.5 DEHYDRATION AND CHARGING**

- .1 Close service valves on factory charged equipment.

- .2 Ambient temperatures to be at least 13 deg C for at least 12 hours before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Charging:
  - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
  - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
  - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .7 Checks:
  - .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
  - .2 Record and report measurements to Engineer..

### **3.6 INSTRUCTIONS**

- .1 Post instructions in frame with glass cover in accordance with Section 01780 - Closeout Submittals and CSA B52.

### **3.7 FEDERAL HALOCARBON REGULATIONS 2003**

- .1 Affix leak test notice to unit as required by Regulations.
- .2 Create service log for turnover to Owner on completion of project as required by Regulations.

**END OF SECTION**

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**PART 1      General**

**1.1            SHOP DRAWINGS AND PRODUCT DATA**

- .1      Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Indicate following:
  - .1      Sealants.
  - .2      Tape.
  - .3      Proprietary Joints.

**1.2            CERTIFICATION OF RATINGS**

- .1      Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**PART 2      Products**

**2.1            DUCT SYSTEM PRESSURE CLASS**

- .1      Fabricate duct and duct system components to SMACNA 250 Pa pressure class.

**2.2            SEAL CLASSIFICATION**

- .1      Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	B
- .2      Seal classification:
  - .1      Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
  - .2      Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.
  - .3      Class C: transverse joints and connections made air tight with gaskets, sealant or combination thereof. Longitudinal seams unsealed.

**2.3            SEALANT**

- .1      Sealant: water based, polymer type flame resistant duct sealant. Temperature range of minus 30 deg C to plus 93 deg C.
  - .1      Acceptable material: Foster 32-19, United, DuroDyne.

**2.4            DUCT LEAKAGE**

- .1      In accordance with SMACNA HVAC Duct Leakage Test Manual.

**2.5            FITTINGS**

- .1      Fabrication: to SMACNA.



- .2 Radiused elbows:
  - .1 Rectangular: Centreline radius of 1.5 times duct dimension in plane of rotation except where duct velocities are less than 4 m/s where radius may be reduced to 1 times.
  - .2 Round: Centreline radius of 1.5 times duct diameter except where duct velocities are less than 4 m/s where radius may be reduced to 1 times.
  - .3 Oval: Centreline radius of 1.5 times duct dimension in plane of rotation except where duct velocities are less than 4 m/s where radius may be reduced to 1 times.
- .3 Mitred elbows, rectangular (to be used only where shown or with permission of Departmental Representative):
  - .1 To 400 mm: with single thickness turning vanes.
  - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 deg entry on branch.
  - .2 Round main and branch: enter main duct at 45 deg with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
- .5 Transitions:
  - .1 Diverging: 20 deg maximum included angle.
  - .2 Converging: 30 deg maximum included angle.
- .6 Offsets:
  - .1 Full short radiused elbows.

## **2.6 FIRESTOPPING**

- .1 Retaining angles around duct, on both sides of fire separation.
- .2 Firestopping material and installation must not distort duct.

## **2.7 GALVANIZED STEEL**

- .1 Lock forming quality: to ASTM A653, G90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class B seal.
  - .1 Acceptable material: Ductmate.

## **2.8 HANGERS AND SUPPORTS**

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.
- .2 Hanger configuration: to SMACNA.

- .3 Hangers: black or galvanized steel angle with galvanized steel rods to SMACNA or following table (whichever is heavier construction).

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25x25x3	6

- .4 Upper hanger attachments:
- .1 For steel joist: manufactured joist clamp.
  - .2 For steel beams: manufactured beam clamps:

### **PART 3 Execution**

#### **3.1 GENERAL**

- .1 Do work in accordance with SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods on duct transporting cold air. Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

#### **3.2 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA.
  - .2 Angle hangers: complete with locking nuts and washers.
  - .3 Hanger spacing: in accordance with SMACNA or following table (whichever is closer spacing).
- | Duct Size<br>(mm) | Spacing<br>(mm) |
|-------------------|-----------------|
| to 1500           | 2000            |

#### **3.3 WATERTIGHT DUCT**

- .1 Provide watertight duct for:
  - .1 Minimum 3000 mm from each air intake.
  - .2 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams. Solder joints of bottom and side sheets. Seal other joints with duct sealer.
- .3 Slope horizontal branch ductwork down towards lowpoint. Slope header ducts down toward risers.

**3.4 SEALING AND TAPING**

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

**3.5 LEAKAGE TESTS**

- .1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.
- .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Do leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.
- .5 Install no additional ductwork until trial test has been passed.
- .6 Test section minimum of 10 m long with not less than two branch takeoffs and two elbows.
- .7 Complete test before insulation or concealment.

END OF SECTION

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**PART 1      General**

**1.1            PRODUCT DATA**

- .1      Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Indicate the following:
  - .1      Flexible connections.
  - .2      Duct access doors.
  - .3      Turning vanes.
  - .4      Instrument test ports.

**1.2            CERTIFICATION OF RATINGS**

- .1      Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**PART 2      Products**

**2.1            GENERAL**

- .1      Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

**2.2            FLEXIBLE CONNECTIONS**

- .1      Frame: galvanized sheet metal frame 24 gauge thick with fabric clenched by means of double locked seams.
- .2      Material:
  - .1      Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40deg C to plus 90deg C, density of 1.0 kg/m<sup>2</sup>.

**2.3            ACCESS DOORS IN DUCTS**

- .1      Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2      Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3      Gaskets: neoprene.
- .4      Hardware:
  - .1      Up to 300 x 300 mm: two sash locks.
  - .2      301 to 450 mm: four sash locks.
  - .3      451 to 1000 mm: piano hinge and minimum two sash locks.

**2.4 TURNING VANES**

- .1 Factory or shop fabricated single thickness or double thickness, to recommendations of SMACNA and as indicated.

**2.5 INSTRUMENT TEST**

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable material: DuroDyne IP-2, Cain.

**PART 3 Execution**

**3.1 INSTALLATION**

- .1 Flexible connections:
  - .1 Install in following locations:
    - .1 Inlets and outlets to supply air units and fans.
    - .2 Inlets and outlets of exhaust and return air fans.
    - .3 As indicated.
  - .2 Length of flexible connection: 75 mm.
  - .3 Minimum distance between metal parts when system in operation: 50 mm.
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on sides of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.
    - .3 Do not install flexible connection direct to fan inlet. Provide minimum 1 fan diameter straight duct at inlet.
- .2 Access doors and viewing panels:
  - .1 Size:
    - .1 600 x 400 mm for servicing entry.
    - .2 450 x 250 mm for viewing.
    - .3 300 x 150 mm minimum size.
  - .2 Locations:
    - .1 Fire dampers.

- .2 Control dampers.
  - .3 Devices requiring maintenance.
  - .4 Required by code.
  - .5 Duct coils.
  - .6 Elsewhere as indicated.
- .3 Instrument test ports.
- .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
    - .2 Locate to permit easy manipulation of instruments.
    - .3 Install insulation port extensions as required.
  - .4 Locations.
    - .1 For traverse readings:
      - .1 Ducted inlets to roof and wall exhausters.
      - .2 Inlets and outlets of other fan systems.
      - .3 Main and sub-main ducts.
      - .4 And as indicated.
    - .2 For temperature readings:
      - .1 At outside air intakes.
      - .2 In mixed air applications in locations as approved by Departmental Representative.
      - .3 At inlet and outlet of coils.
      - .4 Downstream of junctions of two converging air streams of different temperatures.
      - .5 And as indicated.
- .4 Turning vanes:
- .1 Install in accordance with recommendations of SMACNA and as indicated.

END OF SECTION

**PART 1      General**

**1.1          PRODUCT DATA**

- .1      Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Indicate the following: Hardware, blade and frame construction .

**PART 2      Products**

**2.1          GENERAL**

- .1      Manufacture to SMACNA standards.

**2.2          SINGLE BLADE DAMPERS**

- .1      Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2      Size and configuration to recommendations of SMACNA, except maximum height 150 mm .
- .3      Locking quadrant with shaft extension to accommodate insulation thickness.
- .4      Inside and outside nylon end bearings.
- .5      Channel frame of same material as adjacent duct, complete with angle stop.

**2.3          MULTI-BLADED DAMPERS**

- .1      Factory manufactured of material compatible with duct.
- .2      Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3      Maximum blade height: 100 mm .
- .4      Bearings: self-lubricating nylon .
- .5      Linkage: shaft extension with locking quadrant.
- .6      Channel frame of same material as adjacent duct, complete with angle stop.

**PART 3      Execution**

**3.1          INSTALLATION**

- .1      Install where indicated.

- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 All dampers to be vibration free.
- .6 Ensure damper operators are observable and accessible.

END OF SECTION



**PART 1      General**

**1.1            PRODUCT DATA**

- .1      Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Indicate the following:
  - .1      Performance data (air pressure drop at flow and air leakage in closed position).
  - .2      Construction details.

**1.2            CLOSEOUT SUBMITTALS**

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

**1.3            CERTIFICATION OF RATINGS**

- .1      Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

**PART 2      Products**

**2.1            MULTI-LEAF DAMPERS**

- .1      Opposed or Parallel blade type as indicated.
- .2      Structurally formed steel , interlocking blades, complete with PVC seals, spring stainless steel side seals, structurally formed and welded galvanized steel frame.
- .3      Pressure fit self-lubricated synthetic bearings.
- .4      Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5      Performance:
  - .1      Leakage: in closed position to be less than 1% of rated air flow at 500 Pa differential across damper.
  - .2      Pressure drop: at full open position to be less than 11 Pa differential across damper at 300 m/s.
- .6      Insulated aluminum dampers:
  - .1      Frames: insulated with extruded polystyrene foam with R factor of 2.0.
  - .2      Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 2.3.
  - .3      Dampers shall be designed for service temperature range from minus 40°C to 100°C.

**2.2 BACK DRAFT DAMPERS**

- .1 Automatic gravity operated , multi leaf, extruded (1.8 mm thick) aluminum construction with synthetic bearings, set in 3.2 mm aluminum frame.

**PART 3 Execution**

**3.1 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section 23 33 00 HVAC - Duct Accessories.
- .5 Ensure dampers are observable and accessible.
- .6 Dampers on ducts or openings connected directly to outside (o/a intake, exhaust, relief, etc.) shall be insulated aluminum style.

END OF SECTION

**PART 1        General**

**1.1            PRODUCT DATA**

- .1        Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Indicate the following:
  - .1        Fire dampers.
  - .2        Fire stop flaps.
  - .3        Fusible links.
  - .4        Design details of break-away joints.

**1.2            CLOSEOUT SUBMITTALS**

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

**1.3            EXTRA MATERIALS**

- .1        Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2        Provide following:
  - .1        5 fusible links of each type.

**1.4            CERTIFICATION OF RATINGS**

- .1        Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**1.5            WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.

**PART 2        Products**

**2.1            FIRE DAMPERS**

- .1        Fire dampers: arrangement Type A, B or C, listed and bear label of ULC/UL, meet requirements of Fire Commissioner of Canada (FCC) and ANSI/NFPA 90A. Fire damper assemblies to be fire tested in accordance with CAN4-S112.
- .2        Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .3        Top hinged: multi-blade hinged sized to maintain full duct cross section.

- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 Retaining angle iron frame as per damper assembly listing, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 For ducts up to and including 300mm in height use Type B with blades completely out of air stream when in open position. Revise if noted on drawings.
- .7 For ducts over 300mm in height use Type A with blades in air stream when in open position. Revise if noted on drawing.
- .8 For round and oval ducts use Type C fire dampers.
- .9 Acceptable material: Controlled Air, Ruskin, Price, Nailor.

## **2.2 FIRE STOP FLAPS**

- .1 To be ULC listed and labelled and fire tested in accordance with CAN4-S112.2.
- .2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps to be held open with fusible link conforming to ULC-S505.

## **PART 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Duct Accessories.
- .5 Coordinate with installer of firestopping.
- .6 Fire Damper
  - .1 Installation of all fire dampers shall be performed according to Manufacturers listed installation instructions. Installation instructions to be submitted to Departmental Representative with approval drawings.
  - .2 All fire damper installations shall adhere to all requirements including but not limited to:
    - sleeve including proper gauge thickness
    - retention angels and securement

- damper to sleeve securement
  - duct to sleeve breakaway connection
  - clearance between opening and sleeve
  - duct access door
- .3 After installation is completed, remove fusible link, operate curtain, replace fusible link after curtain is returned to open position. Curtain shall operate freely to closed position without assistance or other intervention.
- .4 Installer shall certify each installation on completion of installation and curtain operation test. Certification shall be recorded in format of form appended to this section. Certification shall be turned over to Departmental Representative prior to inspection of installation.
- .7 Install break-away joints of approved design on each side of fire separation.
- .8 Coordinate with work of Section 23 05 93. Repair or replace installations where required for completion of TAB contract.

END OF SECTION

**PART 1        General**

**1.1            PRODUCT DATA**

- .1        Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Indicate the following:
  - .1        Thermal properties.
  - .2        Friction loss.
  - .3        Acoustical loss.
  - .4        Leakage.
  - .5        Fire rating.

**1.2            CERTIFICATION OF RATINGS**

- .1        Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**1.3            SAMPLES**

- .1        Submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

**PART 2        Products**

**2.1            GENERAL**

- .1        Factory fabricated to CAN/ULC S110.
- .2        Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3        Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50 for any portion of flexible duct including jacket.

**2.2            METALLIC - UNINSULATED**

- .1        Type 1: spiral wound flexible aluminum.
- .2        Performance:
  - .1        Factory tested to 3.0 kPa without leakage.
- .3        Acceptable material: Flexmaster T/L, Thermaflex, UniFlex.

**2.3 METALLIC - INSULATED**

- .1 Type 2: spiral wound flexible aluminum with factory applied, 25 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket.
- .2 Performance:
  - .1 Factory tested to 3.0 kPa without leakage.
- .3 Acceptable material: Flexmaster TL-VT, ThermaFlex, UniFlex.

**PART 3 Execution**

**3.1 DUCT INSTALLATION**

- .1 Install in accordance with: SMACNA.
- .2 Do not allow turns tighter than 1.5 diameter radius.
- .3 Do not allow accumulated turns greater than 90°. Install duct elbows where greater turn angle is required.

END OF SECTION

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**PART 1      General**

**1.1          PRODUCT DATA**

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

**PART 2      Products**

**2.1          DUCT LINER**

- .1      General:
  - .1      Fibrous glass duct liner: air stream side faced with mat facing.
  - .2      Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.
- .2      Rigid:
  - .1      Use on flat interior plenum surfaces (ducts with any single dimension greater than 1.5 m or with access to interior will be considered a plenum).
  - .2      25 mm thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.
  - .3      Density: 48 kg/m<sup>3</sup> minimum.
  - .4      Thermal resistance to be minimum 0.76 m<sup>2</sup>. deg C/W for 25 mm thickness when tested in accordance with ASTM C177, at 24 deg C mean temperature.
- .3      Flexible:
  - .1      Use on round, oval or rectangle (except plenums) surfaces.
  - .2      25 mm thick, to CGSB-51-GP-11M, fibrous glass blanket duct liner.
  - .3      Density: 24 kg/m<sup>3</sup> minimum.
  - .4      Thermal resistance to be minimum 0.63 m<sup>2</sup>. deg C/W for 25 mm thickness when tested in accordance with ASTM C177, at 24 deg C mean temperature.
- .4      Acceptable material: Knauf, Owens Corning, Johns Manville, Certain Teed.

**2.2          ADHESIVE**

- .1      Meet requirements of NFPA 90A and NFPA 90B.
- .2      Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 deg C to plus 93 deg C.

**2.3          FASTENERS**

- .1      Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.

**2.4          JOINT TAPE**

- .1      Poly-vinyl treated open weave fiberglass membrane 50 mm wide.



**2.5 SEALER**

- .1 Meet requirements of NFPA 90A and NFPA90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 deg C to plus 93 deg C.

**PART 3 Execution**

**3.1 GENERAL**

- .1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.

**3.2 DUCT LINER**

- .1 Install in accordance with manufacturer's recommendations, and as follows:
  - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive.
  - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres.

**3.3 JOINTS**

- .1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
  - .1 Bed tape in sealer.
  - .2 Apply one coat of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Departmental Representative.
- .3 Protect leading edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct where air velocity in duct exceeds 7.6m/s.

END OF SECTION

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**PART 1      General**

**1.1            SHOP DRAWINGS AND PRODUCT DATA**

- .1      Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Provide :
  - .1      Fan performance curves showing point of operation, BHP and efficiency.
  - .2      Sound rating data at point of operation.
- .3      Indicate:
  - .1      Motors, sheaves, bearings, shaft details, electrical data and all other pertinent information.
  - .2      Minimum performance achievable with variable speed controllers..

**1.2            CLOSEOUT SUBMITTALS**

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

**1.3            EXTRA MATERIALS**

- .1      Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .1      Spare parts to include:
    - .1      Matched sets of belts (one set for each set installed).
- .2      Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

**1.4            MANUFACTURED ITEMS**

- .1      Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

**PART 2      Products**

**2.1            FANS GENERAL**

- .1      Capacity: flow rate, static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
- .2      Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
- .3      Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.

- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.
- .5 Motors:
  - .1 In accordance with Section 20 10 10 Mechanical - Motors, Drives and Guards supplemented as specified herein.
  - .2 For use with variable speed controllers where noted.
  - .3 Sizes as indicated.
  - .4 Two speed with two windings and speeds as indicated.
- .6 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet safety screens as indicated and as specified in Section 20 10 10 Mechanical - Motors, Drives and Guards.
- .7 Factory primed before assembly in colour standard to manufacturer.
- .8 Scroll casing drains: as indicated.
- .9 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .10 Vibration isolation: to Section 23 05 48 Mechanical - Vibration Isolation and Seismic Control.
- .11 Flexible connections: to Section 23 33 00 Mechanical - Duct Accessories.

## **2.2 CABINET FANS - GENERAL PURPOSE**

- .1 Fan characteristics and construction: as centrifugal fans.
- .2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, inside or outside casing as noted.
- .3 Fabricate casing of zinc coated or phosphate treated steel reinforced and braced for rigidity. Provide removable panels for access to interior. Uncoated, steel parts shall be painted over with corrosion resistant paint to CGSB 1-GP-181M. Finish inside and out, over prime coat, with rust resistant enamel. Internally line cabinet with 25 mm thick rigid acoustic insulation, pinned and cemented.
- .4 Acceptable material: Cook, Greenheck, Penn.

## **2.3 UTILITY SETS**

- .1 Characteristics and construction: for centrifugal fans.
- .2 Preassemble single width centrifugal fan with removable weatherproof protective hood with vents.
- .3 Provide belt driven sets with adjustable motor bed plate.

- .4 Acceptable material: Cook, Greenheck, Acme.

**2.4 IN-LINE CENTRIFUGAL FANS**

- .1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and direct or belt drive as indicated.
- .2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.
- .3 Acceptable material: Cook, Greenheck, Acme.

**PART 3 Execution**

**3.1 FAN INSTALLATION**

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration Isolation and Seismic Control, flexible electrical leads and flexible connections in accordance with Section 23 33 00 Mechanical - Duct Accessories.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

END OF SECTION

**PART 1      General**

**1.1          PRODUCT DATA**

- .1      Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Indicate the following:
  - .1          Capacity.
  - .2          Throw and terminal velocity.
  - .3          Noise criteria.
  - .4          Pressure drop.
  - .5          Neck velocity.
  - .6          Construction and finish.
  - .7          Mounting details.

**1.2          SAMPLES**

- .1      Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Samples are required for following:
  - .1          Secure area grilles.

**1.3          CERTIFICATIONS**

- .1      Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**PART 2      Products**

**2.1**

- .1      Provide standard product to meet capacity, throw, noise level, throat and outlet velocity.
- .2      Where grilles, registers and diffusers penetrate fire walls and fire partitions, provide approved steel sleeve secured to structure in accordance with NFPA 90A-1985.
- .3      Frames:
  - .1          Steel: prime coated with exposed welded joints and mitred corners.
  - .2          Aluminum: extruded with welded joints and mitred corners.
  - .3          Provide full perimeter gaskets.
  - .4          Provide plaster frames as plaster stops where set into plaster or gypsum board at all locations.
  - .5          Provide concealed fasteners and operators as specified.
- .4      Sizes and capacities: as indicated in Schedule on drawings.

- .5 Standard of Acceptance: E.H. Price, Titus, Krueger, Nailor.

## 2.2 SECURITY GRILLES

- .1 Type A: Detention supply air grilles

- .1 Body shall be constructed of not less than 11 gauge thick hot rolled steel plate and shall be 50 mm longer than wall or ceiling surface in which grille is to be installed. Faceplate shall be of 5 mm thick hardened steel with 50 mm square holes at 63.5 mm on centre. Faceplate to extend 65 mm beyond outside of body to form face flange with smooth radiused edges. An inner 16 gauge perforated plate with 2.4 mm diameter holes at 3.6 mm on centre staggered at 60° shall be spot welded to the backside of the faceplate. Spot welds to be located at each corner of 50 mm square openings and centred in between as well as one spot weld at each corner of the plate. Finish in one coat of factory primer.

- .1 Acceptable Products: Gunnebo (Chubb) OP20V, Simpson V-2.

- .2 Type B: Detention exhaust air grilles

- .1 Body shall be constructed of not less than 11 gauge thick hot rolled steel plate and shall be 50 mm longer than wall or ceiling surface in which grille is to be installed. Faceplate shall be of 5 mm thick hardened steel with 50 mm square holes at 63.5 mm on centre. Faceplate to extend 65 mm beyond outside of body to form face flange with smooth radiused edges. An inner 16 gauge perforated plate with 2.4 mm diameter holes at 3.6 mm on centre staggered at 60° shall be spot welded to the backside of the faceplate. Spot welds to be located at each corner of 50 mm square openings and centred in between as well as one spot weld at each corner of the plate. Finish in one coat of factory primer.

- .1 Acceptable Products: Gunnebo (Chubb) OP20V, Simpson V-2.

## PART 3 Execution

### 3.1 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with flat head colour matched screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place.
- .4 All diffusers, grilles and registers shall fit level, square and plumb to building lines with frame tight to adjacent surface. Where mounted in acoustic tile ceiling, centre in tile as shown on Architects reflected ceiling plan.

END OF SECTION

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**PART 1      General**

**1.1            PRODUCT DATA**

- .1      Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Indicate the following:
  - .1      Pressure drop.
  - .2      Face area.
  - .3      Free area.
  - .4      Materials of construction, construction methods and dimensions.

**1.2            TEST REPORTS**

- .1      Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

**1.3            CERTIFICATION OF RATINGS**

- .1      Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**PART 2      Products**

**2.1            WALL LOUVRE**

- .1      Stationary drainable louvre manufactured of alloy 6063-T5 extruded aluminum with 150 mm blades positioned at a 35° angle. 12 mm x 12 mm bird screen. Channel frame to be set into exterior wall with flashing and caulking similar to as shown for exterior entry doors. Louvre shall be painted in color as selected by Architect. Louvre shall be all welded construction.
  - .1      Acceptable product: Price DE635 welded construction.

**PART 3      Execution**

**3.1            INSTALLATION**

- .1      In accordance with manufacturer's and SMACNA recommendations.
- .2      Reinforce and brace as indicated.
- .3      Anchor securely into opening. Seal with caulking around to ensure weather tightness.
- .4      All fasteners shall be installed from inside throat of louvre so as not to be accessible from exterior areas.

END OF SECTION

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**PART 1      General**

**1.1            SHOP DRAWINGS AND PRODUCT DATA**

- .1      Submit shop drawing and product data in accordance with Section 01 33 00 - Submittal Procedures.

**1.2            CLOSEOUT SUBMITTALS**

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

**1.3            MAINTENANCE MATERIALS**

- .1      Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2      Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

**1.4            EXTRA MATERIALS**

- .1      Spare filters: in addition to filters to be installed immediately prior to acceptance by Departmental Representative, supply 1 complete set of filters for each filter unit or filter bank in accordance with section 01 78 00 - Closeout Submittals.

**PART 2      Products**

**2.1            GENERAL**

- .1      Media: suitable for air at 100% RH and air temperatures between minus 40 and 50°C.
- .2      Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.
- .3      Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

**2.2            ACCESSORIES**

- .1      Holding frames: channel section construction of galvanized steel, 1.6 mm thick, except where specified otherwise.
- .2      Seals: to ensure leakproof operation.
- .3      Blank-off plates: as required, to fit all openings and of same material as holding frames.
- .4      Access and servicing: through doors/panels on each side and/or from upstream face of filter bank where indicated.



**2.3 RIGID, SUPPORTED PLEAT TYPE FILTERS, 25-30% EFFICIENCY**

- .1 Media: disposable preformed cotton/polyester blend cartridge.
- .2 Holding frame: high wet strength cardboard.
- .3 Media support: welded wire grid.
- .4 Performance:
  - .1 Average atmospheric dust spot efficiency 25-30% to ASHRAE 52.1.
  - .2 MERV 8 to ASHRAE 52.2.
- .5 Fire rated: to ULC -S111.
- .6 Acceptable material: Camfil FARR 30/30, AAF, Air Guard.

**PART 3 Execution**

**3.1 INSTALLATION GENERAL**

- .1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

**3.2 REPLACEMENT MEDIA**

- .1 Replace all media with new upon acceptance.

END OF SECTION

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**Part 1           General**

**1.1           REFERENCES**

- .1 American National Standards Institute (ANSI) / American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE 52.1-1992, Gravimetric and Dust Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
  - .2 American National Standards Institute (ANSI) / Canadian Standards Association (CSA International)
    - .1 ANSI Z21.47-2007A/ CSA 2.3A-2007, Gas-Fired Central Furnaces.
    - .2 ANSI Z83.8 -2006/CSA 2.6-2006, CSA Standard for Gas Unit Heaters and Gas-Fired Duct Furnaces.
  - .3 Canadian Electrical Code
  - .4 Canadian Standards Association (CSA International)
    - .1 CAN/CSA-B149.1-05, Natural Gas and Propane Installation Code.

**1.2           SUBMITTALS**

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

**1.3           CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for incorporation into manual.

**1.4           MAINTENANCE MATERIAL SUBMITTALS**

- .1 Provide spare parts as follows: Nine spare filters for each filter installed at time of turn-over.

**Part 2           Products**

**2.1           GENERAL**

- .1 Furnace units shall be built to the level of quality as herein specified and to the description of the furnace schedule.
- .2 Unless stated otherwise, furnace units are to be shipped to the job in one piece, factory assembled. Units assembled to achieve a close proximation to the intent of this specification will not be considered equal. All equipment shall where specified and applicable, be pre-wired, and factory certified by an approved testing agency such as ETL, UL, CSA prior to shipment.

- .3 Pre-wired furnace units shall bear an approved label with all the necessary identification marks, electrical data, and any necessary cautions as required by the Canadian Electrical Code.
- .4 All electrical circuits shall undergo a dielectric strength test, and shall be factory tested and checked as to proper function.
- .5 The furnace units and major components shall be products of manufacturers regularly engaged in the production of such equipment.

## 2.2 UNIT CONSTRUCTION

- .1 Unit casing shall be of minimum 20 gauge (1 mm) satin coat galvanized sheet metal. Surfaces shall be cleaned with a degreasing solvent to remove oil and metal oxides and primed with a two-part acid based etching primer. Finish coat shall be an electrostatically applied enamel, to all exposed surfaces. All unprotected metal and welds shall be factory coated.
- .2 All walls, roofs and floors shall be of formed construction, with at least two breaks at each joint. Joints shall be secured by sheet metal screws or pop rivets. Wall and floor joints shall be broken in and on all outdoor units roof joints broken out (exposed) for rigidity. All joints shall be caulked with a water resistant sealant.
- .3 Units shall be provided with access doors to the following components: fans and motors, filters, dampers and operators, electrical control panels, burner compartments. Access doors shall be large enough for easy access. Removal of screwed wall panels will not be acceptable.
- .4 Units shall be provided with:
  - .1 Lift out access doors, with extruded neoprene gasket, fully lined, and a minimum of two camlock fasteners for all units up to 48 in. (1220 mm) high.

## 2.3 FANS

- .1 Centrifugal fans shall be rated in accordance with AMCA Standard Test Code, Bulletin 210. Fan manufacturer shall be a member of AMCA. All fans and fan assemblies shall be dynamically balanced during factory test run. Fan shafts shall be selected for stable operation at least 20 % below the first critical RPM. Fan shafts shall be provided with a rust inhibiting coating.
- .2 Single low pressure forward curved fans of 18" (457 mm) or less diameter, shall be equipped with permanently lubricated cartridge ball bearings, supported by a 3 point "spider" bearing bracket in the fan inlets. All other forward curved fan assemblies shall be equipped with greasable pillow block bearings, supported on a rigid structural steel frame.
- .3 Drives shall be adjustable on fans with motors 7 ½ HP (5.6 kW) or smaller. All drives shall be provided with a rust inhibiting coating.

- .4 Motor, fan bearings and drive assembly shall be located inside the fan plenum to minimize bearing wear and to allow for internal vibration isolation of the fan-motor assembly, where required. Motor mounting shall be adjustable to allow for variations in belt tension.
- .5 Fan-motor assemblies shall be provided with vibration isolators. Isolators shall be bolted to steel channel secured to unit floor. The isolators shall be neoprene-in-shear type for single 9" (230 mm) to 15" (380 mm) diameters forward curve fans. Fans shall be attached to the discharge panel by a polyvinyl chloride coated polyester woven fabric, with a sealed double locking fabric to metal connection.
- .6 All single-phase belt drive motor applications shall include rubber isolation for motors ¼ H.P. (.19kw) through 1 ½ H.P. (1.1kw). Provide internal sprig isolation for single phase motors over 1 ½ H.P. (1.1 kW)
- .7 Fan motors shall be ODP super high efficiency.

## 2.4 INDIRECT FIRED MAKE-UP AIR

- .1 General
  - .1 Provide self-contained, factory assembled, pre-wired units consisting of cabinet, supply blower, heat exchanger, burner, controls, air filter, belt drive, and motor. Unit shall be CSA approved for Canada.
  - .2 Indoor units shall have cabinets with 20ga.(1mm) cold rolled steel with baked enamel finish. Provide easily removed and secured access doors to service the filter, fan, controls, and burner.
  - .3 Heat exchanger shall be stainless steel of welded construction. Maximum temperature rise 100°F (55.6°C).
  - .4 Furnace cabinet to be lined with one-half inch (13mm) foil backed fibreglass insulation. Balance of cabinetry for make-up air applications, lined with ½" (13mm) neoprene coated insulation.
  - .5 Fans shall be centrifugal type, rubber mounted with belt drive, adjustable variable pitch motor pulley, rubber isolated hinge mounted 1750 rpm motor, Assembly shall slide out for ease of service.
  - .6 Air filters shall be 2" (50 mm) pleated disposable type arranged for ease of service.
  - .7 Safety controls to include electronic flame supervision when intermittent ignition option is chosen.
  - .8 High limit temperature control, with fixed stop at maximum permissible setting, to de-energize burner when temperature drops to lower safe value.
  - .9 Units shall be propane gas fired. Provide all parts required with installation instructions for field conversion to natural gas at later date.
  - .10 Power supply shall be 120 volts, 1 phase.
- .2 Burner

- .1 Gas burner to be atmospheric type adjustable combustion air supply, equipped with combination 24 volt main gas/pilot valve/pressure regulator incorporating manual shut-off, automatic 100% shut off, and intermittent electronic ignition system. Burner and control assembly shall slide out for ease of service.
- .2 Unit(s) shall accommodate “B” type venting. “B” vent sizing must be in accordance with CAN/CSA Standard B149.1, ANSI Z223.1-NFPA 54, and local authorities having jurisdiction.
- .3 Furnace Configuration
  - .1 Furnace configuration shall be down flow.
- .4 Controls
  - .1 Burner operative controls for make-up air applications to include Maxitrol modulating electronic discharge air control set at 60°F(16°C).
  - .2 Supply optional Maxitrol room override to provide 40°F(22°C) increase in discharge air temperature in response to signal from a 24-volt room thermostat. (Note: Mechanical liquid filled expansion bulbs not acceptable for room over-ride applications.) Room override shall be 7 day/24 hour programmable with LCD touch screen to allow non-occupied set back/set up operation.
  - .3 Room override shall include cooling control to operate remote condensing unit. Switch over to be manual. Heating to be inoperative when switched to cooling.
  - .4 Furnace manufacturer shall provide integrated panel to control operation of furnace, air conditioning, outside air intake damper, return air damper, exhaust damper(s) and exhaust fan(s). Provide operation and components as follows: (Refer to Section 25 90 01 for field wiring and component installation).
    - .1 Furnace / Air Conditioning: As previously described – operated from space programmable thermostat with discharge air temperature control.
    - .2 Interlocked exhaust fans: Open insulated discharge damper(s) and start fan(s) during occupied operation (as set from programmable thermostat). Include provision of 24 VAC damper actuators (spring close) for installation on dampers specified elsewhere.
  - .5 Panel shall include full wiring diagram.

## 2.5 AIR CONDITIONER

- .1 Condensing unit manufactured with copper/aluminum coil, scroll compressor, direct drive condenser fan all in heavy gauge steel enclosure with louvred face for enhanced coil protection. Condensing unit shall use R-410A refrigerant and operate at above 13 SEER. Include compressor low ambient cut-off, timed off control refrigerant service valves and compressor crankcase heater.
  - .1 Acceptable product: Lennox 13 ACX, Carrier, Trane

- .2 Indoor coil shall be manufactured with copper/aluminum coils, housed in downflow cabinets constructed of heavy gauge steel with internal insulation, coil access panels and condensate drain pan. Coil shall be matched to condensing unit. Include expansion valve. Contractor shall fabricate support/transition for furnace connection.

- .1 Acceptable product: Lennox CR33, Carrier, Trane.

**Part 3 Execution**

**3.1 APPLICATION**

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

**3.2 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions, regulations of authorities having jurisdiction and to CAN/CSA-B149 and Canadian Electric Code.
- .2 Provide welded steel wall support stand where noted on drawing.
- .3 Pipe condensate drains from combustion and air conditioner coil to nearest floor drain. Secure pipe to walls. Avoid crossing floors unless required to reach floor drain location. Maintain positive slope in direction of drain.

**3.3 NATURAL GAS CONVERSION**

- .1 Furnaces are to be installed, commissioned and operate on propane gas initially. Provide all conversion components packaged with unit to allow future conversion.

**END OF SECTION**

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**Part 1           General**

**1.1           REFERENCES**

- .1   American National Standards Institute (ANSI)
  - .1   ANSI C2-1990, National Electrical Safety Code.
  - .2   ANSI/NFPA 70-1990, National Electrical Code.
- .2   Canadian Standards Association (CSA)
  - .1   CSA C22.1-98, Canadian Electrical Code, Part 1.
  - .2   CAN/CSA C22.3No.1-M87, Overhead Systems.

**1.2           PERSONNEL QUALIFICATIONS**

- .1   Qualified supervisory personnel to:
  - .1   Continuously direct and monitor all work.

**Part 2           Products**

**2.1           SPECIAL SUPPORTS**

- .1   Structural grade steel, primed and painted after construction and before installation.

**2.2           WIRING**

- .1   As per requirements of Division 26.
- .2   For 70V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.
- .3   For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.
- .4   Sizes:
  - .1   120V Power supply: to match or exceed breaker, size #12 minimum.
  - .2   Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.
  - .3   Field wiring to digital device: 20AWG stranded twisted pair.
  - .4   Analog input and output: shielded #20 minimum stranded twisted pair. Wiring must be continuous without joints.
  - .5   More than 4 conductors: #22 minimum solid copper.
- .5   Terminations:
  - .1   Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

## **2.3 CONDUIT**

- .1 As per requirements of Division 26.
- .2 Electrical metallic tubing to CSA C22.2 83. Flexible and liquid tight flexible metal conduit to CSA C22.2 56. Rigid steel threaded conduit to CSA C22.2 45.
- .3 Junction and pull boxes: welded steel.
  - .1 Surface mounting cast FS: screw-on flat covers.
  - .2 Flush mounting: covers with 25 mm minimum extension all round.
- .4 Cabinets: sheet steel, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard. Panels to be keyed alike for similar functions and or entire contract as approved.
- .5 Outlet boxes: 100 mm minimum, square.
- .6 Conduit boxes, fittings:
  - .1 Bushings and connectors: with nylon insulated throats.
  - .2 With push pennies to prevent entry of foreign materials.
- .7 Fittings for rigid conduit:
  - .1 Couplings and fittings: threaded type steel.
  - .2 Double locknuts and insulated bushings: use on sheet metal boxes.
  - .3 Use factory "ells" where 90 degree bends required for 25 mm and larger conduits.
- .8 Fittings for thin wall conduit:
  - .1 Connectors and couplings: steel, set screw type.

## **2.4 WIRING DEVICES, COVER PLATES**

- .1 Conform to CSA.
- .2 Receptacles:
  - .1 Duplex: CSA type 5-15R.
  - .2 Single: CSA type 5-15R.
  - .3 Cover plates and blank plates: finish to match other plates in area.

## **2.5 STARTERS, CONTROL DEVICES**

- .1 Starter diagrams:
  - .1 Provide copy of wiring and schematic diagrams - mount one copy in each starter with additional copies for operation and maintenance manual.
- .2 Auxiliary Control Devices:
  - .1 Control transformers: 60 Hz, primary voltage to suit supply, 120 V single phase secondary, VA rating to suit load plus 20% margin.
  - .2 Auxiliary contacts: one "Normally Open" and one "Normally Closed" spare auxiliary contact in addition to maintained auxiliary contacts as indicated.



- .3 Hand-Off-Automatic switch: heavy duty type, knob lever operator.
- .4 Double voltage relays: with barrier to separate relay contacts from operating magnet. Operating coil voltage and contact rating as indicated.

## **2.6 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT**

- .1 Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.
  - .1 Hollow masonry walls, suspended drywall ceilings: toggle bolts.
- .2 Exposed conduits or cables:
  - .1 50 mm diameter and smaller: one-hole steel straps.
  - .2 Larger than 50 mm diameter: two-hole steel straps.
- .3 Suspended support systems:
  - .1 Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.
  - .2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

### **3.2 SUPPORTS**

- .1 Install special supports as required and as indicated.

### **3.3 ELECTRICAL GENERAL**

- .1 Do complete installation in accordance with requirements of:
  - .1 Division 26, this specification.
  - .2 CSA 22.1 Canadian Electrical Code.
  - .3 ANSI/NFPA 70.
  - .4 ANSI C2.
- .2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage above 70 V contacts and mark to prevent accidental injury.
- .3 Do underground installation to CAN/CSA C22.3No.7, except where otherwise specified.
- .4 Conform to manufacturer's recommendations for storage, handling and installation.
- .5 Check factory connections and joints. Tighten where necessary to ensure continuity.
- .6 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.

- .7 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.
- .8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.
- .9 Install conduits, and sleeves prior to pouring of concrete.
- .10 Holes through exterior wall and roofs: flash and make weatherproof.
- .11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.
- .12 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

### 3.4

#### **CONDUIT SYSTEM**

- .1 All wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to main control panel. Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems. Maximum conduit fill not to exceed 40%. Design drawings do not show conduit layout.
- .2 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference. Conduit shall be installed tight to building structure unless authorized by the Engineer.
- .3 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Engineer before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.
- .4 Locate conduits at least 150 mm parallel from hot pipes and at least 50 mm at crossovers.
- .5 Bend conduit so that diameter is reduced by less than 1/10th original diameter.
- .6 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.
- .7 Limit conduit length between pull boxes to less than 30 m.
- .8 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.
- .9 Fastenings and supports for conduits, cables, and equipment:
  - .1 Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.
  - .2 Provide adequate support for raceways and cables, sloped vertically to equipment.
  - .3 Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval from Engineer.
- .10 Install polypropylene fish cord in empty conduits for future use.
- .11 Where conduits become blocked, remove and replace blocked sections.

- .12 Pass conduits through structural members only after receipt of Engineer's written approval.
- .13 Conduits may be run in flanged portion of structural steel.
- .14 Group conduits wherever possible on suspended or surface channels.
- .15 Pull boxes:
  - .1 Install in inconspicuous but accessible locations.
  - .2 Support boxes independently of connecting conduits.
  - .3 Fill boxes with paper or foam to prevent entry of construction material.
  - .4 Provide correct size of openings. Reducing washers not permitted.
  - .5 Mark location of pull boxes on record drawings.
  - .6 Identify AC power junction boxes, by panel and circuit breaker.
- .16 Install terminal blocks or strips indicated in cabinets.
- .17 Install bonding conductor for 120 volt and above in conduit.
- .18 No conduit shall be exposed in non-secure areas.
- .19 Particular care is to be taken when laying out and installing conduit and devices in secure Y-chases. Conduit and devices are to be mounted so they do not protrude into service space. Orient to back side of duct or pipe to be close to wall.

### **3.5 WIRING**

- .1 Install multiple wiring in ducts simultaneously.
- .2 Do not pull spliced wiring inside conduits or ducts.
- .3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.
- .4 Tests: use only qualified personnel. Demonstrate that:
  - .1 Circuits are continuous, free from shorts, unspecified grounds.
  - .2 Resistance to ground of all circuits is greater than 50 Megohms.
- .5 Provide Engineer with test results showing locations, circuits, results of tests.
- .6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.
- .7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.
- .8 Do not allow wiring to come into direct physical contact with compression screw.
- .9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

### **3.6 WIRING DEVICES, COVER PLATES**

- .1 Receptacles:
  - .1 Install vertically in gang type outlet box when more than one receptacle is required in one location.
  - .2 Cover plates:
    - .1 Install suitable common cover plate where wiring devices are grouped.
    - .2 Use flush type cover plates only on flush type outlet boxes.

### **3.7 STARTERS, CONTROL DEVICES**

- .1 Install and make power and control connections as indicated.
- .2 Install correct over-current devices.
- .3 Identify each wire, terminal for external connections with permanent number marking identical to diagram.
- .4 Performance Verification:
  - .1 Operate switches and controls to verify functioning.
  - .2 Perform start and stop sequences of contactors and relays.
  - .3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

### **3.8 GROUNDING**

- .1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.
- .2 Install separate grounding conductors in conduit within building.
- .3 Install ground wire in all PVC ducts and in tunnel conduit systems.
- .4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

### **3.9 TESTS**

- .1 General:
  - .1 Perform following tests.
  - .2 Give 14 days written notice of intention to test.
  - .3 Conduct in presence of Engineer and authority having jurisdiction. Engineer will have option to forego attendance and allow test to proceed.
  - .4 Conceal work only after tests satisfactorily completed.
  - .5 Report results of tests to Engineer in writing.
  - .6 Preliminary tests:
    - .1 Conduct as directed to verify compliance with specified requirements.
    - .2 Make needed changes, adjustments, replacements.

- .3 Insulation resistance tests:
  - .1 Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.
  - .2 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of Engineer and authority having jurisdiction.

**END OF SECTION**

**Part 1            General**

**1.1                Purpose**

- .1        Control sequences are intended to relay the general intent of how mechanical systems are to operate. They are not intended to give direct instruction in the construction or programming of the system.
- .2        Each control sequence to be custom programmed for its intended function. Provide documentation of control sequence logic used herein.

**Part 2            Products**

**2.1                Not Used**

**Part 3            Execution**

**3.1                General**

- .1        Contractor shall provide full EMCS control of all mechanical components of building unless noted specifically to be controlled otherwise.
- .2        All noted set points to be adjustable through EMCS.

**3.2                Sequence**

- .1        Furnace Systems
  - .1        Refer to Section 23 54 16 for sequence. Intent is for furnace manufacturer to prepackage controls with furnace units. This contractor shall provide all wiring (including components) and provide start-up and commissioning.

END OF SECTION

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**Part 1            General**

**1.1                SUMMARY**

- .1    Section Includes:
  - .1    General requirements that are common to sections found in Division 26 – Electrical, 27 – Communications and 28 - Electronic Safety and Security.
  - .2    This section supplements the requirements of Division 1.

**1.2                REFERENCES**

- .1    Canadian Standards Association (CSA International)
  - .1    CSA C22.1-09, Canadian Electrical Code, Part 1 (21st Edition), Safety Standard for Electrical Installations.
  - .2    CAN/CSA-C22.3 No. 1-01, Overhead Systems.
  - .3    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).
- .4    Within these specifications reference is made to the following standards:
  - .1    CSA - Canadian Standards Association.
  - .2    CEMA - Canadian Electrical Manufacturers Association.
  - .3    NEMA - National Electrical Manufacturers Association.
  - .4    IEEE - Institute of Electrical and Electronic Engineers.
  - .5    IPCEA - Insulated Power Cable Engineers Association.

**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.

**1.4                DRAWINGS AND SPECIFICATIONS**

- .1    Should any discrepancies occur in the drawings and/or the specifications which leaves doubt as to the true intent and the meaning of the drawings and/or specifications, obtain a ruling from the Consultant before submitting tender.

- .2 Electrical drawings indicate the location and route to be followed by conduit and/or wire and do not show all structural and mechanical details. In some cases, conduit or wiring is not shown or is shown diagrammatically on a schematic or riser diagram. Install each conduit and wire to provide a complete operating component or system and to conserve head room within furring spaces, etc.
- .3 In order to provide sufficient details and maximum degree of clarity on the drawings, the symbols used for various electrical devices, particularly wall mounted devices, take up more space on the drawings than the device does on the wall. In these instances, locate the device on the wall as indicated on detail floor plans or elevations and/or with primary regard for convenience of operations rather than stringing the devices out along the wall so as to coincide with the scale location of electrical symbols.

## **1.5 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
  - .1 Submit drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control.
  - .1 Submit test results of installed electrical systems and instrumentation.
  - .2 Permits and fees: in accordance with the General Conditions of this contract and:
    - .1 Consultant will submit to the Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
    - .2 Contractor will be responsible for paying associated fees.
  - .3 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
  - .4 Furnish Certificates of Acceptance from Electrical Inspection Department authorities having jurisdiction on completion of work to Engineer and Consultant.
- .4 Manufacturer's Field Reports: submit to Engineer and Consultant manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

## **1.6 ELECTRICAL DIAGRAMS**

- .1 Provide single line electrical diagrams under plexiglass in glazed frames as follows:
  - .1 Electrical distribution system: locate in main electrical room.
- .2 Provide fire alarm plan and zoning of building at fire alarm control panel and annunciator locations. Fire alarm plan to show graphic of building floorplans with all zones indicated in separate colors. Plan to be made from plastic laminate and be supplied by the fire alarm manufacturer. The fact that the system is an addressable fire alarm system does not relieve the contractor of this requirement. All addressable devices are to be zoned partitioned for the purpose of aiding the fire department via this building plan.
- .3 Provide fire alarm riser in O&M manual. Riser to show all devices in the installed system and not just be a 'typical' installation.



- .4 Drawings: 600 x 600 mm minimum size, framed with plexiglass cover securely affixed to walls at required locations.

### **1.7 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: Electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction and as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

### **1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Engineer with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

### **1.9 CARE, OPERATION AND START-UP**

- .1 Instruct operating personnel in the 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 all aspects of its care and operation.
- .4 Manufacturers to provide demonstrations and instructions on all equipment and systems.
- .5 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
- .6 Operating Personnel shall be contacted at the beginning of the project and encouraged to come on site at least once a week for the duration of the project. During these periods, they shall be given full explanation of the various systems as the project progresses.
  - .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .7 Time allocation: Two (2) days with minimum of two(2) hours per day. Instruction to be provided during regular work hours.

- .8 Maintain log of all site visits. Maintenance personnel to login/out and be witnessed by Contractor. Provide log as requested.

**1.10 Excessive Administration**

- .1 When the design Consultant performs the final review to verify that the Work is complete, and finds that the Work is not complete, the Contractor will be charged per diem rates plus travel for each additional trip required to establish completion of the Work.

**Part 2 Products**

**2.1 UNIFORMITY OF EQUIPMENT**

- .1 Unless otherwise specifically requested, uniformity of manufacture shall be maintained for any particular item or type of equipment throughout the building.

**2.2 MATERIALS AND EQUIPMENT**

- .1 Equipment or material specified by technical description only, to be of the best commercial quality obtainable for the purpose.
- .2 All electrical equipment, materials and systems specified and shown on the drawings shall be new and be certified by an accredited standards development organization (SDO) by the Standards Council of Canada (SCC). The local authorities having jurisdiction in the province of Saskatchewan must also recognize the certifying SDO.
- .3 Where authorized SDO certified equipment and material is not available, submit such equipment and material to authority having jurisdiction/ inspection authorities for special approval before delivery to site.
- .4 Factory assemble control panels and component assemblies.

**2.3 ALTERATIONS**

- .1 Additional work or deletions shall be resolved in the manner described in the General Conditions.
- .2 Any prices submitted for additional work or alterations shall include a price breakdown for all labour and material and where required, shall be justified by invoices, time sheets, etc. No extras will be allowed without prior written authorization from the Engineer.

**2.4 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: in accordance with Section 26 05 21 – Wires and Cables (0-1000 V) except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

**2.5 MECHANICAL EQUIPMENT**

- .1 Check mechanical drawings for sizes and locations of all motors, controls, and other equipment requiring electrical wiring and connections.
- .2 Review mechanical specifications to ensure compliance with all clauses requiring work by the electrical contractor.
- .3 Ensure that tendered price includes for all requirements for electrical work noted in mechanical plans and specifications.

**2.6 MANUFACTURERS AND CERTIFICATION LABELS**

- .1 Visible and legible after equipment is installed.

**2.7 WARNING SIGNS**

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction and the Engineer.
- .2 Porcelain enamel or decal signs, minimum size 175 x 250 mm.

**2.8 WIRING TERMINATIONS**

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

**2.9 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, lettering accurately aligned and engraved into 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/ Consultant prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate and label.

- .5 Identification to be English.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Panelboards shall have two nameplates, one on front cover and one on inside trim; indicating panel designation and voltage.
- .10 'ON/OFF' switches: indicate areas being served.
- .11 Distribution centres: identify distribution centres as shown on the drawings and main voltage or voltages if more than one.

**2.10 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1, red, black, blue with neutral white.
- .4 Use colour coded wires in communication cables, matched throughout system.

**2.11 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.

<u>Description</u>	<u>Prime</u>	<u>Auxiliary</u>
up to 250 V	Gray	
Telephone	Green	
Structured Wiring System	White	Black
DC emergency Lighting	Black	Red
Security Systems	Red	Yellow
Fire Alarm	Red	
Emergency Voice	Red	Blue

**2.12 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

- .1 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
  - .1 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

### **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, approved Standards Council of Canada SDO 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.
- .4 Obtain prior approval from Consultant before installing any equipment or conduit through roofing membrane. Provide pitch pockets or roof jacks where approval is given.

#### **3.4 FIRESTOPPING**

- .1 Perform firestopping on penetrations, made for the purpose of the Electrical Work, in accordance with Section 07 84 00 – Firestopping

#### **3.5 LOCATION OF OUTLETS**

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150mm 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. Obtain information from Consultant prior to rough-in of outlet.

- .4 Determine direction of door swings from architectural drawings or on site, not from electrical drawings. Locate light switches, fire alarm manual stations, and disconnect devices in mechanical room, on latch side of each door or as detailed on elevations or detail floor plans.

### **3.6 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1200 mm.
  - .2 Wall receptacles:
    - .1 General: 450 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 100 mm.
    - .4 In mechanical rooms: 1400 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Communication outlets: 450 mm.
  - .5 Wall mounted telephone and interphone outlets: 1500 mm.
  - .6 Fire alarm pull stations: 1200 mm.
  - .7 Fire alarm horns/bells: 2100 mm. Confirm with Architectural Elevations.

### **3.7 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### **3.8 WARRANTY**

- .1 Furnish a written warranty to the Owner stating:
  - .1 That all Work will be free from defects for a period of one year or for a period as specified in individual sections of the work, from the date of Substantial Performance of the Work as defined by the Consultant.
  - .2 This section agrees to repair and replace at own expense, all such defective work and other work damaged which fails or becomes defective during the term of the guarantee provided that such failure is not caused by improper usage.
  - .3 The period of the warranty specified above shall in no way supplant any other warranty of a longer period but shall be binding on work not otherwise covered.
- .2 Include original copy of warranty in operations and maintenance manual in accordance with this section.

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### **3.9 SETTING OUT THE WORK**

- .1 Thoroughly examine the drawings and specifications and especially check figure dimensions immediately after awarding of the contract. Report any discrepancies to the Consultant. No pleas as to the action or direction of the Consultant will be submitted in justification of any errors in construction where departure is made from the drawings, specifications or contract.
- .2 In setting out the Work, make reference to the Electrical, and Architectural drawings. Consult with respective trades in setting out of location of the conduit runs, lighting fixtures, panel assemblies, etc. so that conflicts are avoided and symmetrical even spacing is maintained.
- .3 Conduit shall be laid out to avoid interference with other trades and to maintain maximum headroom. In the ceiling space, conduit shall be arranged to conserve space, to be serviceable and to avoid crossovers.
- .4 Where outlets occur in exterior walls, utilize vapour boxes.
- .5 No structural member shall be cut or drilled without the knowledge and consent of the Structural Consultant.
- .6 No holes shall be cored in the existing slab unless slab is x-rayed first. Electrical contractor is responsible for costs of performing x-ray services related to his work.

### **3.10 FIELD QUALITY CONTROL**

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases within 15% of each other and record changes.
  - .2 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, 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 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 Motors full-load amperage: In co-operation with the Mechanical trade, take clip-on ammeter readings on all phases of all mechanical equipment motors with motors operating under full load conditions. Test readings to be submitted to Mechanical section and to the Consultant. Results are also to be recorded in the O&M manual.
  - .6 Systems: fire alarm system, communications.
  - .7 Insulation resistance testing:

- .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
- .2 Check resistance to ground before energizing. If ground resistance is less than .2 megohms on any lighting, power or control circuit, such circuits shall be considered as being defective and must be replaced.
- .3 Carry out tests in presence of Engineer and/or Consultant.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
  - .1 Where Manufacturer's field services are called for in technical sections 26, 27 and 28:
  - .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 as described in PART 1 - SUBMITTALS.
  - .3 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.
  - .4 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
  - .5 Arrange and pay for the services of the manufacturer's personnel to supervise the initial start-up of the installation and to check, adjust, balance and calibrate all components, including all related wiring, controls, etc. and to instruct the Owner's operating personnel.
  - .6 Provide services for such period and for as many visits as may be necessary to put the applicable portion of the installation into complete working order and to ensure that the operating personnel are fully conversant with all aspects of the operation, care and maintenance thereof. In general, this shall include all communication equipment such as fire alarm system, etc.
- .6 During construction and up to Substantial Performance of the work, Contractor shall be required to make accessible any equipment or wiring for inspection purposes.
- .7 Contractor shall have at all times a member of his supervisory staff available to assist the Consultant in inspecting the work.
- .8 Submit all test results for Engineer's / Consultant's review.

### **3.11 CLOSEOUT SUBMITTALS**

- .1 In accordance with Section 01 78 00 – Closeout Submittals.
- .2 Include in operating and maintenance (O&M) manuals:
  - .1 Names of the pieces of equipment used in the project, the manufacturer's name on each piece of equipment and the name and address of the supplier of the equipment. Wherever pieces of equipment form part of a complete system, the system name shall be used on the list: i.e. Fire Alarm System.
  - .2 Part numbers of all replaceable items.



- .3 Manufacturer's cut sheets and rating tables including brochures of all major equipment supplied for the project.
- .4 Complete electrical load data from operating tests: Voltages on all phases, line to line and line to neutral and ampacity on each phase, with the building in normal operating condition. Measurements to be taken on the main incoming feeder.
- .5 Serial numbers of all principal pieces of equipment.
- .6 Manufacturer's pictures and descriptive data, along with all equipment and engineering data on every light fixture supplied and installed on the project.
- .7 Recommended maintenance procedures for various systems.
- .8 Results of all tests performed.
- .9 All testing certificates and Inspection Department Acceptance
- .10 Contractor's Warranty
- .11 Other articles and documents listed elsewhere in these project specifications.

### **3.12 SPARES**

- .1 Submit spares in accordance with Section 01 78 40: Maintenance Requirements.

### **3.13 RECORD DRAWINGS**

- .1 'As-built' Record drawings: in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Contractor to provide 1 set of marked up electrical as-built drawings. Provide sets of white prints of the construction drawings. Mark thereon all changes as work progresses and as changes occur. This shall include changes to all electrical systems as shown in the tender documents. Ensure that items marked correspond to the drawing title.
  - .1 Use different colour waterproof ink for each service on a per drawing basis.
  - .2 Make mark-ups available for reference purposes and inspection at all times during construction.
- .3 Up-to-date, as-built drawings are to be present and on-site at all times, and must be available upon request of the Consultant when performing site construction reviews. This item will be requested, and status reflected, for reviewing of progress claims throughout the project period.

### **3.14 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 At all times during construction, keep the site free from debris boxes, packing, etc., resulting from the work of the Divisions 26, 27 and 28.
- .4 At the completion of the Work, the electrical installation shall be left in a clean and finished condition to the satisfaction of the Consultant.

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**3.15 CONTRACT BREAKDOWN**

- .1 Provide separate material and labour breakdown for Divisions 26, 27 and 28 sub-contract as indicated below. This breakdown is to meet the satisfaction of the Consultant and is to be submitted within 14 days of contract award.
  
- .2 The breakdown will be used in the computing of progress claims. Progress claims are to be itemized with separate labour and material listing against each item of the contract breakdown. Progress draws will not be reviewed if they are not presented as per the following breakdown:
  - .1 Service and Distribution
  - .2 Lighting and Branch
  - .3 Power Branch Circuitry
  - .4 Fire Alarm System
  - .5 Emergency & Exit Lighting
  - .6 Structured Wiring
  - .7 Security Systems
  - .8 Mechanical equipment provisions

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.
- .2        CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

**1.2                PRODUCT DATA**

- .1        Submit product data in accordance with Section 26 05 00 – Common Work Results – Electrical.

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials.
- .2        Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3        Fold up metal banding, flatten and place in designated area for recycling.

**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 600 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        Insulation:
  - .1        Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.
- .4        Inner jacket: polyvinyl chloride material.
- .5        Armour: interlocking galvanized steel.
- .6        Overall covering: polyvinyl chloride material.
- .7        Fastenings:

- .1 One hole malleable iron straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at 1500 mm centers.
- .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
  - .1 Watertight (where applicable) approved for TECK cable.

### **2.3 MINERAL-INSULATED CABLES**

- .1 Not allowed.

### **2.4 ARMOURED CABLES**

- .1 Conductors: insulated, copper size as indicated, minimum #12 AWG.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.

### **2.5 CONTROL CABLES**

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket, and optional armour of closely wound aluminum wire.
- .2 Low energy 300 V control cable: solid annealed copper conductors sized minimum #16 AWG, with PVC insulation, flamer retardant to 105 degrees C.

### **2.6 FIRE ALARM CABLE**

- .1 Conductors: 300V rated multi-conductor, insulated, colour coded, copper conductor, minimum size to be #16 B & S gauge for device loops and #14 for signal circuits.
- .2 Insulation: 105 degrees C flame retardant PVC
- .3 Outer Jacket: 105 degrees C flame retardant PVC Red.
- .4 Armour: Interlocking Aluminum without overall Jacket. For drops to devices in suspended ceilings from conduit system.
- .5 Certified by CSA as fire alarm and signal cable type FAS 105 to CSA C22.2 #208

### **2.7 NON-METALLIC SHEATHED CABLE**

- .1 Not Permitted.

## **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 In cable trays in accordance with Section 26 05 36

**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.
- .3 Armoured cables are only allowed for light fixture drops in suspended ceilings or applications specifically indicated elsewhere within the contract documents.

**3.4 INSTALLATION OF CONTROL CABLES**

- .1 Install control cables in conduit.
- .2 Ground control cable shield at one end only.

**END OF SECTION**

**Part 1           General**

**1.1               RELATED SECTIONS**

- .1       Section 26 05 00 - Common Work Results - Electrical.

**1.2               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)

**1.3               WASTE MANAGEMENT AND DISPOSAL**

- .1       Separate and recycle waste materials.
- .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 for recycling.
- .4       Divert unused metal materials from landfill to metal recycling facility as approved by Engineer.
- .5       Fold up metal banding, flatten and place in designated area for recycling.

**Part 2           Products**

**2.1               EQUIPMENT**

- .1       Rod electrodes: copper clad steel stainless steel 19 mm dia by 3 m long.
- .2       Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .3       Insulated grounding conductors: green, type TWH.
- .4       Ground bus: copper, size 55mm x 6mm x 1219mm, complete with insulated supports, fastenings, connectors.
- .5       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.

## 2.2 MANUFACTURERS

- .1 Standard of Acceptance for equipment: Burndy Corp., Erico Inc., McGraw Edison (Canada) Ltd.

## 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 and make secure electrical connection between conduit and ground wire with ground hub. System is to conform to the requirements of the Consultant and the local authorities having jurisdiction.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process, permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837. As a minimum, all connections to the approval of the authorities having jurisdiction.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Install separate ground conductor to outdoor lighting standards.
- .9 Connect building structural steel and metal siding to ground by welding copper to steel.
- .10 Make grounding connections in radial configuration only, with connections terminating at single grounding point Avoid loop connections.
- .11 Ground secondary service pedestals.

### 3.2 ELECTRODES

- .1 Use electrode components and copper conductors as indicated on the drawings.
- .2 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

- .3 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .4 Install water meter shunt.

### **3.3 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.

### **3.4 WATER MAIN CONNECTION**

- .1 From the main electrical room ground bus, connect a bare ground conductor to water main with approved ground clamp, ahead of water meter. Install a ground conductor jumper of flexible copper strapped around water meter and associated unions and valves to ground building side of water system.

### **3.5 GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0AWG.

### **3.6 COMMUNICATION SYSTEMS**

- .1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
  - .1 Install a 300mm x 25mm x 6mm copper main ground bus (MGB) in an appropriate location, 350mm above the finished floor on the backboard in each one of the Telecommunications/LAN closet and equipment room.
  - .2 Connect the two busbars to each other and back to the main service ground connection point by green-insulated #2 AWG TWH stranded copper conductor.
  - .3 Telephone 1 #6 TWH to telephone service conduit.
  - .4 Structured wiring equipment: 1 #6 TWH to MGB for each rack and section of cable tray.
  - .5 Fire alarm and detection 1 #6 TWH in 16mm conduit to nearest ground bus.

### **3.7 BONDING**

- .1 Ensure proper bonding of existing and new systems and provide bonding where required as follows: Bond non-current carrying metal parts together with size #6 AWG copper equipotential conductor. Run conductor from separate lug or service neutral bar to, but not necessarily limited to, the following indoor systems and equipment:
  - .1 Hot water heating system
  - .2 Domestic cold water piping.
  - .3 Fuel system piping.
  - .4 Sprinkler piping.



**3.8 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

**END OF SECTION**

**Part 1            General**

**1.1                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials.
- .2        Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3        Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling.
- .4        Divert unused metal materials from landfill to metal recycling facility as approved by Engineer.
- .5        Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**2.1                SUPPORT CHANNELS**

- .1        U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended, set in poured concrete walls and ceilings.
- .2        All hardware shall be galvanized or equal.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Secure equipment to hollow, solid masonry, tile and plaster surfaces with lead anchors.
- .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 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 For surface mounting of two or more conduits use channels at 2 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 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.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Where screw fastenings are used on metal decking, screws are to be set in lower flutes only.
- .15 Equipment and conduits to be installed to maintain head room, neat mechanical appearance and sized to support equipment loads as required.

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings and product data for cabinets in accordance with Section 26 05 00 – Common Work Results – For Electrical.

**1.2                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials.
- .2        Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3        Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**2.1                SPLITTERS**

- .1        Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2        Main and branch lugs and/or Connection bars 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.

**2.2                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.

**2.3                CABINETS**

- .1        Sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2        Backboards: 19 mm G1S fir plywood, one-piece backboards shall be installed in telephone cabinets only. All other cabinet shall have a removable raised metal back panel.
- .3        All cabinet shall be approved for the type of wiring and equipment to be housed therein.
- .4        Terminal strips:
  - .1        Below 50 volts - screw terminal type, Armaco T12-2 or Cinch Series 500.
  - .2        Above 50 volts - 250 volt screw terminal type with barriers between each set of terminals with individual terminal points for each conductor, Weidmuller SAK 2.5 #2796.2 terminals C/W rail, end plates and holding clamps.

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**2.4 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name voltage and phase.

**2.5 WIRING IDENTIFICATION**

- .1 In cabinets, identify terminal strips with permanent numbers.
- .2 Provide wiring diagram on inside of terminal cabinet door showing units and conductors connected to terminal cabinets.

**Part 3 Execution**

**3.1 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.

**3.2 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 and as per the requirement of the Canadian Electrical Code.
- .4 Terminate conduit in cabinet with locknuts and Bushings and/or locknuts and grounding bushing where required.
- .5 Terminate wiring on screw tight terminal blocks or strips.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1            CSA C22.1-2009, Canadian Electrical Code, Part 1.

**1.2                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate and recycle waste materials.
- .2            Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**Part 2            Products**

**2.1                OUTLET AND CONDUIT BOXES GENERAL**

- .1            Size boxes in accordance with CSA C22.1.
- .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            Combination boxes with barriers where outlets for more than one system are grouped.
- .6            Use 102mm square deep-type boxes for structured wiring system.

**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 walls.
- .5            Sectional boxes and handy boxes are not permitted.

**2.3                MASONRY BOXES**

- .1            Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

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**2.4 CONCRETE BOXES**

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.
- .2 In masonry utilize 'deep' style boxes approved for masonry use.

**2.5 FLOOR BOXES**

- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.
- .2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12 mm and 19 mm conduit. Minimum size: 73 mm deep.

**2.6 BOXES FOR RIGID STEEL CONDUIT**

- .1 Cast FS or FD aluminum or ferrous boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

**2.7 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.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 All outlet boxes to be flush mounted in all areas excluding mechanical rooms, electrical rooms and above removable ceilings.
- .3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .5 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve net openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.

- .6 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .7 Boxes shall not be mounted back to back.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
  - .2 CSA C22.2 No. 45-M1981(R1992), Rigid Metal Conduit.
  - .3 CSA C22.2 No. 56-1977(R1999), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 83-M1985(R1999), Electrical Metallic Tubing.
  - .5 CSA C22.2 No. 211.2-M1984(R1999), Rigid PVC (Unplasticized) Conduit.
  - .6 CAN/CSA C22.2 No. 227.3-M91(R1999), Flexible Nonmetallic Tubing..

**1.2 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**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, steel, liquid-tight flexible metal.
- .5 Non metallic duct: rigid PVC, FRE duct and “superduct”

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 53 mm and smaller. Two hole steel straps for conduits larger than 53 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 2 m oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

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**2.3 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 27 mm and larger conduits.
- .3 Set screw connectors and couplings for EMT except where not allowed by the Canadian Electrical Code. Water-tight fittings for all outdoor and weatherproof EMT requirements.

**2.4 EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm 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 areas of open structure.
- .3 Where surface conduits are used in finished areas of open ceiling structure, conduit is to be inconspicuous and tucked neatly along structural members – hidden if possible. Finish of conduit and boxes in these areas to match architectural finish of ceiling.
- .4 Use rigid galvanized steel threaded conduit where specified.
- .5 Use electrical metallic tubing (EMT) except where subject to mechanical injury.
- .6 Install and attach surface mounted conduit with clamps for exposed runs.
- .7 Underground conduit shall be FRE or PVC, sand buried, with the concrete cap.
- .8 Use liquid tight flexible metal conduit for connections to motors or vibrating equipment.
- .9 Co-ordinate installation of conduit in masonry work to avoid horizontal runs.
- .10 Minimum conduit size for power circuits: 21 mm.
- .11 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

- .12 Mechanically bend steel conduit over 21 mm dia.
- .13 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .14 Install fish cord in empty conduits.
- .15 Run 2-27 mm spare conduits up to ceiling space and 2- 27 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 300x300x100 mm junction boxes in ceiling space.
- .16 Clean out conduit before installation of conductors. Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
- .17 Alter routing to avoid structural obstructions keeping crossovers to a minimum.
- .18 Seal conduit with fibreglass where conduits leave heated area and enter unheated area.
- .19 Flashing and pitch-pockets making watertight joints shall be provided by General Contractor where conduits pass through roof or waterproofing membranes.
- .20 Install CSA approved expansion fittings complete with grounding jumpers where conduits cross building expansion joints. Provide bends or offsets in conduit adjacent to building expansion joints where conduit is installed above suspended ceilings.
- .21 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .22 All conduits shall enter properly and be secured to all fittings, outlet boxes, panel tubs, etc., by means of locknuts and bushings. All unused openings shall be sealed with a threaded plug.

### **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 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.

### **3.3 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

- .4 Where conduit is located in wall cavities in occupied spaces, route to avoid contact with plumbing and other services to the drywall and studs. The plumbing and other services are being installed clear of drywall and studs and electrical conduit can provide a solid connection to transmit noise from the plumbing to the drywall if routed without adequate clearance.

### **3.4 CONDUITS IN CAST-IN-PLACE CONCRETE**

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

### **3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE**

- .1 Run conduits 27 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

### **3.6 CONDUITS UNDERGROUND**

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1    Canadian Standards Association (CSA International)
  - .1        CAN/CSA C22.2No.126-M91(R1997), Cable Tray Systems.
- .2    National Electrical Manufacturers Association (NEMA) standards
  - .1        NEMA FG 1-1993, Fibreglass and Cable Tray Systems.
  - .2        NEMA VE 1-1998, Metal Cable Tray Systems.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1    Submit shop drawings and product data in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2    Identify types of cabletroughs used.
- .3    Show actual cabletrough installation details and suspension system.

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1    Separate and recycle waste materials.
- .2    Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3    Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4    Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.
- .5    Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**2.1                CABLETROUGH**

- .1    Tray shall be made of high mechanical strength carbon steel wires with a minimum diameter of 4.5 mm for widths from 50 to 200 mm and 5 mm from 300 to 450 mm.
- .2    Tray shall be constructed with a 53 mm x 101 mm mesh construction. It shall be electroplated with a zinc coating to resist corrosion and enhance wire life.
- .3    Tray shall meet applicable CSA standards and requirements and be CSA certified.
- .4    All tray welds shall be manufactured to a tensile strength of 700 kg per weld.
- .5    Complete assembly of cabletray, and necessary accessories, free of burrs or sharp edges. Edges to be round and smooth.

- .6 Cable tray size to be 300mm wide and 53mm deep.
- .7 Standard of acceptance: CODE Manufacturing 'Web Tray', T&B Express Tray or approved equivalent.

## **2.2 FITTINGS AND CONNECTORS**

- .1 Standard manufacturer approved splicing accessories and cable tray connectors and hangers shall be used throughout the installation.

## **2.3 SUPPORTS**

- .1 Provide supports as required and recommended by manufacturer's installation instructions for the size and loading as required.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install complete cabletrough system.
- .2 Support cabletray from building structure. Do not attach to installations of other mechanical or electrical systems.
- .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.
- .4 All cable trays shall have a bare copper grounding conductor in accordance with C.E.C. 12- 2210. Grounding conductor shall be minimum #6 in communications trays.

### **3.2 CABLES IN CABLETROUGH**

- .1 Install cables individually.
- .2 Cable tray is intended for Structured wiring systems only. No other electrical system is permitted to be run in the tray.
- .3 Secure cables in cabletrough at 6 m centres, with cloth velcro ties.
- .4 Identify cables every 30 m in accordance with Section 27 10 00 – Structured Cabling.

**END OF SECTION**

**Part 1            General**

**1.1                PRODUCT DATA**

- .1        Submit product data in accordance with Section 26 05 00 – Common Work Results – Electrical.

**Part 2            Products**

**2.1                PHOTOELECTRIC LIGHTING CONTROL**

- .1        Wall mounting.
- .2        Capable of switching 1800 W of lighting at 120 V.
- .3        Voltage variation: plus or minus 10%.
- .4        Temperature range: minus 40 °C to plus 40 °C.
- .5        Rated for 5000 operations.
- .6        Options:
  - .1        Twist-lock type receptacle.
  - .2        Sensitivity adjustment.
- .7        Switching time delay of 30 s.
- .8        Wall mounting bracket.
- .9        Colour coded leads: size 10 AWG, 460 mm long.

**2.2                CONTACTOR**

- .1        Cabinet mounting.
- .2        Capable of switching multiple lamp circuits with total lighting load as indicated on the drawings.
- .3        Manual override via a 3 position HAND – OFF – AUTO Switch.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install photoelectric controls in accordance with manufacturer's instructions.
- .2        Photo-electric cell is to control all exterior building mounted lighting as indicated on the drawings.

- .3 The selector switch positions shall be "ON", "OFF" and "AUTO". "ON" position will bypass photoelectric cell and allow for manual switching of exterior luminaires. Provide Lamicaid labels for switch position indicators.
- .4 Mount selector switch in face of enclosure.

**END OF SECTION**



**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Materials and installation for standard and custom breaker type panelboards.

**1.2                RELATED SECTIONS**

- .1            Section 26 05 00 - Common Work Results - Electrical.
- .2            Section 26 28 21 - Moulded Case Circuit Breakers.

**1.3                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.

**1.4                SHOP DRAWINGS**

- .1            Submit shop drawings in accordance with 26 05 00 - Common Work Results – Electrical.
- .2            Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
- .3            Proof of compatible series rated combination groups for breakers and equipment is to be provided with shop drawings.

**1.5                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate and recycle waste materials.
- .2            Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3            Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4            Divert unused metal and wiring materials from landfill to metal recycling facility approved by Engineer.

**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            250 V panelboards: bus and breakers rated for 25000A (symmetrical) interrupting capacity or as indicated.

- .3 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.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating as mains.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: air dried grey enamel.
- .10 Branch circuit panelboards and breakers within are to be part of a series rated combination group which is compatible with the upstream breakers and service entrance board.
- .11 Standard of Acceptance:
  - .1 240 Volt: Cutler-Hammer Pow-R-Line 1, Square D type NQOD, Siemens type NLAB.

## **2.2 BREAKERS**

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Lock-on devices for fire alarm, exit and emergency light circuits.

## **2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 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 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

- 
- .3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results – Electrical or as indicated.
  - .4 Connect loads to circuits.
  - .5 Connect neutral conductors to common neutral bus with respective neutral identified.
  - .6 Mount panelboard vertically with odd numbered breakers on the left and even on the right.
  - .7 Wherever possible use pull boxes to collect home runs and larger conduits to complete the return of the branch circuits to avoid conduit congestion at the face of walls

**END OF SECTION**

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**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Switches, receptacles, wiring devices, cover plates and their installation.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2            CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3            CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.
  - .4            CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

**1.3                SHOP DRAWINGS AND PRODUCT DATA**

- .1            Submit shop drawings and product data in accordance with Section 26 05 00 - Common Work Results - Electrical

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate and recycle waste materials.
- .2            Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3            Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4            Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

**Part 2            Products**

**2.1                SWITCHES**

- .1            General Purpose:
  - .1            15 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
  - .2            Manually-operated general purpose ac switches with following features:
    - .1            Terminal holes approved for No. 10 AWG wire.
    - .2            Silver alloy contacts.
    - .3            Urea or melamine molding for parts subject to carbon tracking.
    - .4            Suitable for back and side wiring.
    - .5            White toggle.

- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Standard Switches of one manufacturer throughout project.
- .5 All switches to be specification grade
- .6 Steel, nickel plated corrosion resistant bridge, prominent amperage marking, colour coded base, one piece rivetless copper alloy spring contact arm and terminal plate, one piece integral grounding terminal with #8 brass screw, stainless steel automatic grounding clip to assure grounding continuity between mounting strap and metal wall box, silver cadmium oxide contacts, back wire entrance for terminations to accept two wires for feed through capability (avoiding pig-tailing) and large brass binding head screws with deep slots.
- .7 Acceptable materials: Hubbell 1201, Leviton 1201 or Cooper 1201 Series.
- .2 Switches with Pilot Lights:
  - .1 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic jewel flush type.
- .3 Switches with Built in Occupancy Sensors:
  - .1 Dual Technology PIR and Ultrasonic/Microphonic Detection.
  - .2 Manually on with auto off.
  - .3 Self contained relay.
  - .4 Adjustable time delay.
  - .5 Color White.
  - .6 Standard of Acceptance: Sensor Switch WSD PDT SA or approved equivalent.
- .4 Keyed Switches:
  - .1 Switches shown as being keyed shall have locking coverplates equal to P&S WPH-1L. All keyed coverplates to be keyed alike. Switches shown as keyed shall be mounted in separate boxes (not ganged) where more than one is required in one location.
- .5 Dimming Switches:
  - .1 Slide dimmers with off setting at bottom of slide position.
  - .2 Capable of 1500W of dimming load.
  - .3 Colour: to match other wiring devices.

## 2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
  - .1 White moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Break-off links for use as split receptacles.
  - .4 Eight back wired entrances, four side wiring screws.
  - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Other receptacles with ampacity and voltage as indicated.

- .3 Receptacles of one manufacturer throughout project.
- .4 Compact heavy duty design with heavy duty wrap around bridge locked into body, Thick wall thermoset base, 0.8mm thick brass triple wipe power contacts with #8 brass screws, eight hole clamp type back wiring and anchor hole to help form solid wire around terminal screw, brass centre rivet, all brass grounding system with pretensioned contacts and impact resistant nylon face.
- .5 Standard of acceptance:
  - .1 Specification Grade: Hubbell 5252 Series, Leviton 5252 Series, P&S 5252 or Cooper 5252 series.
- .6 Identify all receptacles as to panel and circuit number on clean plastic mylar sticker, permanently affixed to the device cover plate.

### **2.3 SPECIAL WIRING DEVICES**

- .1 Transient protected receptacles:
  - .1 common and normal mode protection, 210 Joules/13000 Amps per mode, audio & visual status indicators, alarm silencing, 500 V maximum suppressed voltage (UL 1449 testing), duplex outlet.
  - .2 Standard of Acceptance: Hubbell 5262S, Leviton 7280, Cooper 5262S or approved equivalent.

### **2.4 COVER PLATES**

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Stainless steel, vertically brushed, 1 mm thick cover plates cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.
- .5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.

- 
- .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical as indicated.
  - .2 Receptacles:
    - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
    - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical as indicated.
    - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
    - .4 Mount Receptacles with u-ground on bottom of receptacle.
  - .3 Cover plates:
    - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
    - .2 Install suitable common cover plates where wiring devices are grouped.
    - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

**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(R2001), 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 01 - Common Work Results – Electrical.
- .2            Submit product data and shop drawings.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate and recycle waste materials.
- .2            Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3            Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling.
- .4            Divert unused metal and wiring materials from landfill to metal recycling facility approved by Engineer.
- .5            Fold up metal banding, flatten and place in designated area for recycling.

**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                BREAKER TYPE GROUND FAULT INTERRUPTER**

- .1            Single or Two pole ground fault circuit interrupter for 15 A, 120 V, 1 phase circuit c/w test and reset facilities.



**2.3 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 Failed test shall render the receptacle inoperable through internal circuitry or mechanical lock out.
- .2 Flush mounted with stainless steel face plate.
- .3 Unit to contain self testing abilities in conformance with CSA and UL 942.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results – Electrical.
- .2 Demonstrate simulated ground fault tests.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

**1.2                REFERENCES**

- .1    Canadian Standards Association (CSA International).
  - .1        CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

**1.3                SUBMITTALS**

- .1    Submit product data in accordance with Section 26 05 01 - Common Work Results – Electrical.
- .2    Include time-current characteristic curves for breakers with ampacity of 200 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .3    Proof of compatible series rated combination groups for breakers and equipment is to be provided with Shop drawings.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1    Separate and recycle waste materials.
- .2    Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**Part 2            Products**

**2.1                BREAKERS GENERAL**

- .1    Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2    Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3    Common-trip breakers: with single handle for multi-pole applications.
- .4    Circuit breakers with interchangeable trips as indicated.
- .5    Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating.
- .6    All breakers in branch circuit panelboards and service entrance switchboard are to be part of a compatible series rated combination group.

**2.2 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.

**2.3 ENCLOSURE**

- .1 Provide wall mounted, NEMA 1 enclosure for all stand alone breakers.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install circuit breakers as indicated.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    Canadian Standards Association (CSA International).
  - .1        CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
  - .2        CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

**1.2                SUBMITTALS**

- .1    Submit product data in accordance with Section 26 05 01 - Common Work Results – Electrical.

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1    Separate and recycle waste materials.
- .2    Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3    Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**2.1                DISCONNECT SWITCHES**

- .1    Fused switches are indicated on the contract drawings. It is not acceptable to provide fused disconnect switches in lieu of breakers. Confirm locations with contract drawings.
- .2    Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure 1, 3R, or 4, to CAN/CSA C22.2 No.4 as required; size as indicated.
- .3    Provision for padlocking in off switch position by locks.
- .4    Mechanically interlocked door to prevent opening when handle in ON position.
- .5    Fuses: size as indicated, in accordance with Section 26 28 14 - Fuses - Low Voltage.
- .6    Fuseholders: to CSA C22.2 No.39 suitable without adaptors, for type and size of fuse indicated.
- .7    Quick-make, quick-break action.
- .8    ON-OFF switch position indication on switch enclosure cover.

**2.2                EQUIPMENT IDENTIFICATION**

- .1    Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

- .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                SCOPE**

- .1        Work includes the coordination of all equipment and devices as required for project completion in accordance with mechanical scope of the project.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Install thermostats for Mechanical heating/cooling equipment provided by Mechanical Contract where specifically indicated on the drawings and/or indicated on the Mechanical drawings.
- .2        Install connections to air valves and branch circuit selectors where applicable. Coordinate with Mechanical drawings and trades to ensure locations of equipment prior to rough-in.
- .3        Electrical shall supply and install all switches, starters, motor controllers and control apparatus required for satisfactory completion of work as outlined in drawings and specifications. All electrical equipment supplied or installed shall have CSA approval for use in its intended location.
- .4        Mechanical Sections will provide as required any necessary wiring diagrams required for equipment.
- .5        Refer to Mechanical drawings and specs for wiring requirements with reference to thermostat and control wiring of heating equipment.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        International Electrotechnical Commission (IEC)
  - .1            IEC 947-4-1-1990, Part 4: Contactors and motor-starters.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings in accordance with Section 26 05 00 - Common Work Results – Electrical.
- .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.

**1.3                CLOSEOUT SUBMITTALS**

- .1        Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 26 05 00 - Common Work Results – Electrical.
- .2        Include operation and maintenance data for each type and style of starter.

**1.4                EXTRA MATERIALS**

- .1        Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2        Provide listed spare parts for each different size and type of starter:
  - .1            3 contacts, stationary.
  - .2            3 contacts, movable.
  - .3            1 contacts, auxiliary.
  - .4            1 control transformers.
  - .5            1 operating coil.
  - .6            2 fuses.
  - .7            10% indicating lamp bulbs used.

**1.5                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials.
- .2        Place materials defined as hazardous or toxic waste in designated containers.
- .3        Ensure emptied containers are sealed and stored safely for disposal away from children.

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**Part 2            Products**

**2.1                MATERIALS**

- .1           Starters: to IEC 947-4 with AC4 utilization category.

**2.2                MANUAL MOTOR STARTERS**

- .1           Single or Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
  - .1           Switching mechanism, quick make and break.
  - .2           One or Three overload heaters, manual reset, trip indicating handle.
- .2           Accessories:
  - .1           Toggle or Key switch: standard labelled as indicated.
  - .2           Indicating light: standard type and red in colour.
  - .3           Locking tab to permit padlocking in "ON" or "OFF" position – where indicated on the drawings.

**2.3                FULL VOLTAGE MAGNETIC STARTERS**

- .1           Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1           Contactor solenoid operated, rapid action type.
  - .2           Motor overload protective device in each phase, manually reset from outside enclosure.
  - .3           Wiring and schematic diagram inside starter enclosure in visible location.
  - .4           Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
  - .5           Hand-off-auto switch in enclosure door.
  - .6           Motor overload devices are to be electronic, self powered, non-thermal type with current sensing, 3:1 current range adjustment, phase unbalance and phase loss protection, harmonically insensitive, ambient insensitive with visible trip indication.
  - .7           Indicating lights: LED Type in Red cover.
  - .8           Two sets of (NO) normally open auxiliary contacts in addition to the standard auxiliary holding contacts supplied with each contactor. One set of auxiliary contacts convertible to normally closed (NC).
- .2           Combination type starters to include motor circuit interrupter or circuit breaker with operating lever on outside of enclosure to control motor circuit interrupter or circuit breaker, and provision for:
  - .1           Locking in "OFF" position with up to 3 padlocks.
  - .2           Independent locking of enclosure door.
  - .3           Provision for preventing switching to "ON" position while enclosure door open.
- .3           Accessories:
  - .1           Selector switches: oil tight labelled as indicated.



- .2 Indicating lights: heavy duty, oil tight type and color as indicated.
- .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

#### **2.4 CONTROL TRANSFORMER**

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

#### **2.5 FINISHES**

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

#### **2.6 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 1 engraved as indicated on motor list to the acceptance of the consultant.

### **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 Section 26 05 00 - Common Work Results – Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

**END OF SECTION**

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**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.
  - .2        ANSI C82.4-92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.
- .2    American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1        ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.
- .3    American Society for Testing and Materials (ASTM)
  - .1        ASTM F1137-88(1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4    United States of America, Federal Communications Commission (FCC)
  - .1        FCC (CFR47) EM and RF Interference Suppression.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1    Submit shop drawings in accordance with Section 26 05 00 - Common Work Results – Electrical.
- .2    Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Engineer. Data MUST be available as .IES files and submitted for incorporation in standard lighting simulation software.
- .3    Photometric data to include: VCP Table spacing criterion.

**1.3                COORDINATION WITH OTHER DIVISIONS**

- .1    Confirm compatibility and interface of other materials with luminaire and ceiling system. Report discrepancies to the Engineer and defer ordering until certified.
- .2    Supply plaster frames, trim rings and backboxes to other trades as the work requires.
- .3    Coordinate with Mechanical to avoid conflicts between luminaires, supports, fittings and mechanical equipment.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1    Separate and recycle waste materials.
- .2    Place materials defined as hazardous or toxic waste in designated containers.
- .3    Ensure emptied containers are sealed and stored safely for disposal away from children.

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**Part 2            Products**

**2.1                LAMPS**

- .1    Fluorescent T-8.
  - .1    Acceptable manufacturers: Sylvania, Philips, GE.
  - .2    32 Watt – Instant start, 4100°K, low mercury, TCLP compliant, 48” nominal length, with the following minimum requirements: 2800 initial lumens, 20,000 hour life for 3 hr average operation time on a instant start programmed start ballast, except where noted otherwise. 85 colour rendering index (CRI), medium bipin.
- .2    Compact Fluorescent
  - .1    Shape and Wattage as indicated on fixture schedule. Base to match fixture requirements. Lamp colour temp. shall be 4100°K. Low mercury, TCLP compliant . Minimum requirements of 10,000 hour life and 82 CRI.
- .3    Metal halide lamps.
  - .1    Voltage and wattage sized per fixture requirements, rated at 20,000 hours, colour corrected to 3200K, with high colour rendering index (CRI).
  - .2    Interior Lamps: coated.
  - .3    Exterior Lamps: clear.

**2.2                BALLASTS**

- .1    T8 Instant Start fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic.
  - .1    Rating: voltage, number of lamps as indicated on drawings.
  - .2    Instant Start.
  - .3    For operation of one or two lamps, using parallel lamp circuitry.
  - .4    RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.
  - .5    Totally encased and designed for 40 deg C ambient temperature.
  - .6    High Power factor.
  - .7    Crest factor: 1.5 maximum current, 2.0 maximum voltage.
  - .8    Capacitor: thermally protected.
  - .9    Thermal protection: non-resettable on coil.
  - .10   Harmonics: 10 % maximum THD, including 49th for electronic discrete and hybrid ballasts, 25 % maximum THD including 49th for electromagnetic ballasts.
  - .11   Operating frequency of electronic ballast: 21 khz minimum.
  - .12   Normal Ballast Factor.
  - .13   Sound rated: Class A.
  - .14   Mounting: integral with luminaire.
  - .15   Acceptable manufacturers: Sylvania, GE, Advance.
- .2    Compact Fluorescent ballast: CSA certified, IC electronic
  - .1    Rating: Wattage, voltage and number of lamps as indicated on fixture schedule.

- .2 Programmed start.
- .3 End-of-life lamp sensing circuit.
- .4 Total Harmonic Distortion less than 10%.
- .3 Metal halide ballast:
  - .1 Rating: voltage and wattage as indicated, for use with metal halide lamp.
  - .2 Totally encased and designed for 40 deg C ambient temperature.
  - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
  - .4 Type: constant wattage auto-transformer.
  - .5 Input voltage range: plus or minus 10% of nominal.
  - .6 Minimum starting temperature: minus 29 deg C at 90% line voltage.
  - .7 Mounting: integral with luminaire or remote where indicated on the contract drawings.
  - .8 Crest factor: 1.8 maximum current, 2.0 maximum voltage.

### **2.3 EMERGENCY POWER FOR BALLASTS**

- .1 In accordance with Section 26 52 01: Unit Equipment for Emergency Lighting.

### **2.4 FINISHES**

- .1 Baked enamel finish:
  - .1 Conditioning of metal before painting:
    - .1 For corrosion resistance conversion coating to ASTM F1137.
    - .2 For paint base, conversion coating to ASTM F1137.
  - .2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel polyester powdercoat, or alzak aluminum to give smooth, uniform appearance, free from pinholes or defects.
  - .3 Reflector and other inside surfaces finished as follows:
    - .1 White, minimum reflection factor 85%.
    - .2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-ometer not to exceed 0.05.
    - .3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.
    - .4 Gloss not less than 80 units as measured with Gardner 60 deg gloss meter.
    - .5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.
    - .6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.
- .2 Alzak finish:
  - .1 Aluminium sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:

- .1 Finish for mild commercial service, minimum density of coating 7.8 g/m<sup>2</sup>, minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.
  - .2 Finish for regular industrial service, minimum density of coating 14.8 g/m<sup>2</sup>, minimum reflectivity 82% for specular and 73% for diffuse.
  - .3 Finish for heavy duty service, minimum density of coating 21.8 g/m<sup>2</sup>, minimum reflectivity 85% for specular, 65% for diffuse.
- .3 Specular Interior Reflectors:
- .1 95% reflectivity as per fixture schedule requirements.

## 2.5 LIGHT CONTROL DEVICES

- .1 Design:
  - .1 Lens thickness: 2.41 mm or as indicated on fixture schedule.
  - .2 Material: as indicated by the requirements on the fixture schedule.

## 2.6 LUMINAIRES

- .1 As per schedule on the drawings.

## 2.7 EXTERIOR LUMINAIRES

- .1 Provide luminaires complete with gaskets forming weatherproof assembly where exposed to weather.
- .2 Luminaire finishes to be non-corrosive types.
- .3 Provide low temperature ballasts as required.

## 2.8 SPARES

- .1 Lamps
  - .1 Spare fluorescent lamps, of each type specified in fixture schedule. Provide a minimum number of spares calculated as follows, and rounded up to the next highest integer:
    - .1 Linear fluorescent - 5% times the total number for installation, minimum 10 lamps.
    - .2 Compact fluorescent – 5% times the total number for installation, minimum 10 lamps.
  - .2 Spare metal halide lamps, of each type specified. Provide a minimum number of spares calculated as follows and rounded up to the next highest integer:
    - .1 Metal Halide – 5% times the total number for installation.
- .2 Ballasts and Accessories
  - .1 Spare fluorescent ballasts, of each type specified in fixture schedule. Provide a minimum number of spares calculated using the following percentages, and rounded up to the next highest integer:
    - .1 Fluorescent ballasts – 5% times the total number for installation.

- .2 Compact Fluorescent ballasts – 5% times the total number for installation.
- .2 Spare metal halide ballasts, of each type specified in fixture schedule. Provide a minimum number of spares calculated using the following percentages and rounded up to the next highest integer:
  - .1 Metal halide ballast – 5% times the total number for installation, minimum 1 ballast.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Locate and install luminaires as indicated.
- .2 Coordinate the location of all lighting fixtures with the sprinkler installer to meet the clearance requirements of ANSI/NFPA 13.
- .3 Supply ballasts of compatible design to lamps and fixtures specified.
  - .1 High intensity discharge ballasts to be mounted complete with rubber grommets to reduce noise transmission.

**3.2 WIRING**

- .1 Connect luminaires to lighting circuits:
  - .1 Bx (AC90) may be used for drops to fixtures in suspended ceiling installations. (Maximum 3 meter drop)
  - .2 Otherwise provide RW90 XLPE in conduit.
- .2 Surface mounted luminaires are to be fed via conduit tucked neatly against structural members, and protruding at right angles from such structure for fixture connection. Contractor to ensure conduit is painted as per ceiling finishes.
  - .1 For fixture drops provide separate junction box for each fixture or row of fixtures where mounted end to end.

**3.3 LUMINAIRE SUPPORTS**

- .1 For suspended ceiling installations support luminaires independently from ceiling.
- .2 Support luminaires mounted in continuous rows once every 1219mm or as per manufacturer recommendation in the case of extruded aluminum or steel.
- .3 Provide plaster frames or plaster trim as required and turn same over to the ceiling section for installation.
- .4 Support all ceiling mounted luminaries by two hangers per luminaire minimum independent of ceiling structure of tee bars.
- .5 At plaster or drywall ceiling systems incandescent fixtures are to be outlet box supported where surface mounted.
- .6 Surface mounted fluorescent fixtures are not to be supported by T-bar clips at T & T ceiling systems.

**3.4 LUMINAIRE ALIGNMENT**

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines, unless otherwise indicated.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Materials and installation for emergency lighting systems.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA C22.2 No.141-M1985(R1999), Unit Equipment fo Emergency Lighting.

**1.3                SUBMITTALS**

- .1            Submit product data in accordance with Section 26 05 00 - Common Work Results – Electrical.
- .2            Data to indicate system components, mounting method, source of power and special attachments.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate and recycle waste materials.
- .2            Remove from site and dispose of packaging materials at appropriate recycling facilities.

**1.5                WARRANTY**

- .1            For batteries, the 12months warranty period prescribed in subsection GC32.1 of General Conditions"C" is extended to 120months, with a no-charge replacement during the first 5 years and a pro-rate charge on the second 5 years.

**1.6                OPERATION**

- .1            Emergency Ballast
  - .1            Emergency lighting shall operate by supplying emergency power to fluorescent lamp ballasts and lamps indicated on drawings.
  - .2            In the case of a power outage, emergency ballast shall detect power outage and provide power supply to the AC ballast, using an integral battery pack.

**Part 2            Products**

**2.1                EMERGENCY BATTERY PACKS**

- .1            Emergency lighting equipment: to CSA C22.2 No.141.
- .2            Supply voltage: 120V, ac.
- .3            Output voltage: 24V dc.
- .4            Operating time: 30 min.



- .5 Wattage:
  - .1 Battery Pack #1 (BP#1) = 144 Watts minimum.
- .6 Battery: sealed, maintenance free with 10 year life expectancy.
- .7 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
- .8 Solid state transfer circuit.
- .9 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .10 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .11 Lamp heads: integral on unit and remote, 345° horizontal and 180° vertical adjustment. Lamp type: Mini halogen with quartz bi-pin housing, 8 watts, voltage to match battery unit output voltage.
- .12 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .13 Housing: Rugged use / Tamper resistant, polycarbonate housing with lamps enclosed within clear, cube-shaped, polycarbonate lenses. Finish: white.
- .14 Finish: white.
- .15 Auxiliary equipment:
  - .1 Ammeter.
  - .2 Voltmeter.
  - .3 Test switch.
  - .4 Time delay relay.
  - .5 Battery disconnect device.
  - .6 AC input and DC output terminal blocks inside cabinet.
  - .7 Shelf/ Bracket where required.
  - .8 Cord and plug connection for ac.
  - .9 RFI suppressors.
- .16 Standard of Acceptance: Lumacell, Emergi-Lite, Luxnet, ReadyLite.

## 2.2 WIRING OF REMOTE HEADS

- .1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized a minimum of #10 awg. Install with conductors sized to maintain current flow with maximum 5% voltage drop.

**Part 3            Execution**

**3.1                INSTALLATION OF EMERGENCY BATTERY PACKS AND REMOTE HEADS**

- .1            Install unit equipment and remote mounted fixtures.
- .2            Direct heads.
- .3            Connect exit lights to unit equipment with conductors sized to maintain current flow with a maximum of 5% voltage drop.

**END OF SECTION**

**Part 1           General**

**1.1               REFERENCES**

- .1     Atomic Energy Control Board Regulations
- .2     Canadian Code for Preferred Packaging
- .3     Canadian Standards Association (CSA)
  - .1     CSA C22.2 No.141- M1985(R1992) , Unit Equipment for Emergency Lighting.
  - .2     CSA C860- 96 , Performance of Internally-Lighted Exit Signs.
- .4     National Fire Protection Association (NFPA) requirements

**1.2               SUBMITTALS**

- .1     Submit product data in accordance with Section 26 05 00 - Common Work Results – Electrical.
- .2     Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.

**1.3               WASTE MANAGEMENT AND DISPOSAL**

- .1     Separate and recycle waste materials
- .2     Place materials defined as hazardous or toxic waste in designated containers.
- .3     Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4     Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .5     Fold up metal banding, flatten and place in designated area for recycling.

**Part 2           Products**

**2.1               STANDARD UNITS**

- .1     Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.
- .2     Housing: cold rolled steel minimum 1.0 mm thick, white enamel finish.
- .3     Face and back plates: cast aluminum alloy.
- .4     Lamps: LED, over 75,000 hours.
- .5     Letters: 150 mm high x 19 mm, with 13 mm thick stroke, red on die-cast face , reading EXIT and SORTIE.

- 
- .6 Ceiling and wall (surface) mounted as indicated on the drawings.
  - .7 Single or Double face, as indicated on drawings.
  - .8 Downlight: translucent acrylic in bottom of unit.
  - .9 Knockout Chevrons: as required.
  - .10 Standard of Acceptance: Lumacell LER400B6\_-C860\_-SP, or EmergiLite, Luxnet or ReadyLite equivalents.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install exit lights.
- .2 Connect fixtures to exit light circuits.
- .3 Ensure that exit light circuit breaker is locked in on position.
- .4 EXIT light circuits are to contain no other electrical loads.

**END OF SECTION**

**Part 1            General**

**1.1                SYSTEM DESCRIPTION**

- .1        Telecommunications raceways system consists of outlet boxes, cover plates, conduits, cabletroughs, pull boxes, fish wires.

**1.2                WORK INCLUDED**

- .1        Conduit, raceways and outlets to form conduit and cable distribution system for telecommunication system as indicated on the drawings and specified herein.

**1.3                WORK NOT INCLUDED UNDER THIS SECTION**

- .1        All telephone cabling, terminations, connections and installation of telephone equipment, except for cabling of telephone handset locations as specified under Section 27 10 00 – Structured Wiring System.

**Part 2            Products**

**2.1                MATERIAL**

- .1        Main Backboard: 1219 MM x 2438MM x 19mm G1S fir plywood.
- .2        Conduits: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .3        Cabletroughs: in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.
- .4        Junction boxes: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .5        Outlet boxes, conduit boxes size, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .6        Fish wire: polypropylene type.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install raceway system, including distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, cabletroughs, miscellaneous and positioning material to constitute complete system.
- .2        All telephone conduit terminating at telephone backboard location to terminate 75mm above bottom or 75mm below top with grounding bushings. All grounding bushings to be interconnected with #12 bond wire and terminated at main ground as specified in Section 26 05 28 – Grounding Secondary.

- .3 Supply and install pull chord in each and every unfilled conduit run.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCE**

- .1        CAN/CSA - T527-94 (R1999): Canadian standard for grounding and bonding, this standard is equivalent to EIA/TIA 607.
- .2        CAN/CSA-T568.1-05: Commercial Building Telecommunications Cabling Standard – Part I, The Canadian equivalent of ANSI/TIA/EIA-568-B.1-2001.
- .3        CAN/CSA-T568.2-05: Commercial Building Telecommunications Cabling Standard – Part II, The Canadian equivalent of ANSI/TIA/EIA-568-B.2-2001.
- .4        CAN/CSA-T568.3-05: Optical Fiber Cabling Components Standard, The Canadian equivalent of ANSI/TIA/EIA-568-B.3-2000.
- .5        IEEE STD 802.3z: The purpose (relative to cabling) of this standard is to define media and distance requirements for 1000 Mbit/s LAN.
- .6        TIA/EIA-606-1993: Design Guidelines for Administration of Telecommunications Infrastructure in Commercial Buildings.
- .7        TIA/EIA-607-1993: Commercial Building Grounding and Bonding Requirements for Telecommunications. The purpose of this standard is provide standards for grounding and bonding for data and telecommunications equipment.
- .8        ANSI/TIA/EIA-568-A-B:Commercial Building Telecommunications Cabling Standard. It addresses the telecommunications wiring system requirements for commercial buildings that support various LAN, data, voice and image/video systems.
- .9        ANSI/TIA/EIA-TSB-95: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems.
- .1        CSA C22.1 2009: Canadian Electrical Code.

**1.2                SYSTEM DESCRIPTION**

- .1        Supply and install a complete telecommunications cabling system that is based on a physical star wiring topology must be designed in accordance with, and supported by, a manufacturer's backed warranty certification (minimum 20 year) as specified herein.
- .2        System to provide an operating level of Category 6 in accordance with all Telecommunication standards.
- .3        All wiring and devices shall conform to CAN/CSA-T568 standards.
- .4        System is limited to cabling installations between communication jacks and Patch Panels in termination racks and any accessory wiring specifically indicated herein or on drawings. Provide all patch panels, racks, jacks, patch cords and other necessary equipment required to provide a manufacturer certified system.

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**1.3 PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Shop drawings to be submitted as outlined herein and to consist of the following:
- .3 Complete material list with style, model number, quantity and technical information on all equipment to be installed. No material or equipment to be delivered to the jobsite prior to receipt of approval of the submitted material list by the consultant and engineer.
- .4 Complete system circuit diagram, block diagrams and shop drawings which clearly illustrate how all components relate and are interconnected. All terminations to be numbered and documented. Under no circumstances will wiring schematics from sales brochures be considered as circuit diagrams for this project

**Part 2 Products**

**2.1 CONFORMITY OF EQUIPMENT AND SYSTEM**

- .1 One manufacturer's products used throughout, or manufacturer approved alternates, in order to meet requirements for manufacturer's certification.

**2.2 COPPER CABLING**

- .1 Cabling from communication jacks to telecommunications patch panels are to be four pair Unshielded Twisted Pair (UTP), 24 AWG formed into four individually twisted pairs. The pair of twists of any pair shall not be the same as the pair of twists of any other pair. The cable shall be able to withstand a bending radius of 25mm without jacket or insulation cracking. The cable shall meet the requirements of CSA C22.1-2009 and be FT4 rated. Cable shall be rated for CAT 6 functionality.
- .2 Cable shall be colour coded as follows:
  - .1 Pair 1 whiteblue-blue,
  - .2 Pair 2 whiteorange-orange,
  - .3 Pair 3 whitegreen-green,
  - .4 Pair 4 whitebrown-brown
- .3 Cable electrical specifications:
  - .1 Nominal Velocity of Propagation(NVP): 72 (% speed if light)
  - .2 DC resistance: 8.9 ohms/100 m Max.
  - .3 DC resistance Unbalanced: <3%
  - .4 Characteristic Impedance: (f - 500Mhz) 100 ohms +/- 15%
  - .5 Delay Skew: 25ns/100m
- .4 Cable physical specifications:
  - .1 Gauge: 24 AWG
  - .2 Weight: 26 lb/1000 ft
  - .3 Outside diameter: < 6.4 mm



- .4 Operating temperature range: -10 to 60 °C
- .5 Jacket Colour: white.
- .5 Standard of Acceptance: Provo 24104L6 with a **white** jacket or approved equivalent.

### 2.3 CONNECTORS

- .1 At each outlet designated on the drawings as a structured wiring outlet provide eight(8) position Cat 6 modular jacks; quantity as shown on the drawings. Wiring connections at the jacks shall be T568A TYPE. Provide jacks at each outlet location c/w colour coded identification labels. Colour coded labels to snap or adhere to face of jacks and are to represent the following: Blue: Data, Yellow – Voice. Alternate labeling schemes will be reviewed.
- .2 Modular Jacks are to be rated suitable for CAT 6 performance and the rated speed.
- .3 Provide corresponding plastic wall plates for telecommunication outlets.

### 2.4 PATCH PANELS

- .1 Patch panels to be mounted on hinging, freestanding 19" racks or on telecommunication backboards as indicated on drawings.
- .2 Patch panels to be CAT 6 component compliant to meet the system as specified herein.
- .3 Patch Panels to have 110 IDC terminations and 8 position jacks, with 24, 48 or 96 ports per panel as indicated on the drawing rack elevations. Patch panel jacks to be wired to T586A Type specifications.
- .4 To feature universal wiring and ANSI/TIA/EIA-606-A labelling.

### 2.5 PATCH CORDS

- .1 Patch cords are to be selected and installed as to provide the manufacturer's certification. Only those patch cords certified by the manufacturer for meeting their certification requirements are to be used.
  - .1 Provide patch chords as required to connect all jacks to their appropriate system as indicated on the drawings.
  - .2 Patch chords used for telephone components are to be yellow in colour.
  - .3 Patch Chords used for data (LAN) are to be blue in colour.
- .2 As part of this contract ten (10) 3 foot patch cords of each colour are to be provided and included as spare parts.

### 2.6 EQUIPMENT RACKS

- .1 Free Standing Floor mounted:
  - .1 19" equipment racks with rear access to punch-down blocks and front access to port connections, 6" cable channels on each side of rack running the full vertical length c/w cover.
  - .2 Size: 2134mm high, 483mm (standard 19") wide.

- .3 Finish: Durable black powder coat.
- .4 Channel Material: 14 gauge cold-rolled steel.
- .5 Cover Material: 16 gauge cold-rolled steel.
- .6 Racks to include Duct style horizontal cable management c/w transition spools.

## 2.7 IDENTIFICATION

- .1 Each cable to be identified by a unique code as specified herein, cable to be identified at each end of it's length. Utilize pre-coded self adhesive vinyl tape for cable identification.
- .2 Each telecommunications jack shall be identified by a unique code as specified herein. Each jack to be identified on plates with self-adhesive or built-in-plate labels according to ANSI/TIA/EIA-606-A labeling scheme.
- .3 Each telecommunications conduit shall be identified by a unique code as specified herein. Conduits are to be tagged with lamiciods such that the lamiciod does not obstruct the conduit throat.
- .4 Each patch panel located in telecommunication closet shall be identified by a unique code as indicated on the drawings and specified herein. Utilized lamiciods with 9.5mm high lettering.

## 2.8 RECORDS

- .1 Provide an Administrative Cable Records for the structured wiring system. The cable record to indicate identifier, termination points, cable use, cable number, cable path from end to end, cable length and test report number for each cable. Database to be both printed and electronic format including labeling according to TIA/EIA-606.
  - .1 Each wired outlet jack to be uniquely identified.
  - .2 Each cable to be identified by unique code.
  - .3 Each cable tray is to be uniquely identified.
  - .4 Each and every conduit and cable tray path that is followed by the cable from the outlet jack to the telecommunication closet is to be recorded using the pathway identifiers.
- .2 The label of the patch panel port to which each cable is connected is to be uniquely identified.
- .3 Provide three ring binder with tabs for hardcopy of administrative cable database, as built drawings and cable test reports.
- .4 The administrative labeling database is to be provided in Microsoft Access format unless otherwise specified.

- .5 Provide Cable data summary sheet as indicated below. Coordinate information requirements from Consultant prior to initiation of testing and database production.

ID	JACK NO	JACK TYPE	JACK USE	CABLE No	CABLE TYPE	PATH # 1	PATH # 2	PCH PNL-#	RACK #	RACK LOC	CAB LENGTH	TST REP#
1		RJ45			CAT 6							
2		fibre			CAT 6							

JACK USES:

V - VOICE	JC	Jack (Copper)
D - DATA	JF	Jack (Fibre)
R - VIDEO (RFTV)	C	Cable
	CD	Conduit
	WW	WireWay (Cable Tray)

- .6 Include in binder: Manufacturer’s Certification Certificate (minimum 20 years)

**2.9 RECORD DRAWINGS**

- .1 Record drawing to be of drafting quality similar to those issued to contractor. Drawings shall be on reproducible Mylars. Drawings shall show all cabling, terminations and labelling for jacks, conduit pathways, cable trays, patch panels and telecommunications closets.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 All telecommunications cabling to be installed in conduit, cable trough system or within computer access flooring. The only exception being cabling between equipment racks and conduit stubs within telecommunication and server rooms.
- .2 From each communication outlet run number of cables indicated on drawings to patch panels as noted. Connect cables to patch panel located in telecommunication closets and server rooms.
- .3 Complete records and record drawings for each component in system and compile binder.
- .4 Provide and Complete labeling as per ANSI/TIA/EIA-606-A and the satisfaction of the owner. Confirm these requirements prior to work.
- .5 Provide 5 spare CAT 6 cables between nearby telecom closets (rack locations) except where fibre is used. Provide 2 meters slack at each end for terminations by owner IT staff.
- .6 Provide labelling for each cable tray, conduit, patch panel as follows:
  - .1 Type 1 on each tray as indicated on drawings with one label on both sides of every second full section of tray.
  - .2 Type 2 label on each section of conduit that returns to a cable tray located where the conduit meets the tray. Use identifiers indicated on drawings.
  - .3 Type 3 label on each patch panel using identifiers as indicated on drawings.

**3.2 TESTING**

- .1 Each channel to be tested for compliance to CAT 6 wiring as per CAN/CSA-T568.1-05 and CAN/CSA-T568.2-05
- .2 Each fibre optic cable to be tested for compliance with CAN/CSA-T568.3-05
- .3 End-to-end testing for UTP copper shall be conducted from both ends for 100% of pairs and shall identify pair reversal, opens, and shorts. The test results shall be documented, corrections implemented and retesting conducted and documented. In addition, documentation shall be presented to show the length of the cable between the Telecommunications Closet and the Work Area. Testing shall be per TIA/EIA-TSB 67 and TIA/EIA- TSB 95 (Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.) All testing shall be done with a level IIe bi-directional Category 6 tester, with updated firmware.
- .4 Test requirements:
  - .1 Length
  - .2 NEXT (Near End Cross-Talk) and PSNEXT (power sum NEXT)
  - .3 Attenuation
  - .4 Wire Map
  - .5 ELFEXT and PSELFEXT (equal level far end cross talk and power sum ELFEXT)
  - .6 Return Loss
  - .7 Propagation delay and Delay Skew
- .5 Provide written verification confirming that transmission performance testing and inspection has been completed and that all cable runs have passed. Also, document that all failures have been identified, corrected, and re-tested successfully.
- .6 Final testing shall be carried out only after substantial completion.
- .7 Provide printed test report of all channels verifying that they meet or exceed CAT 6 channel requirements. Place in manual.

**END OF SECTION**

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**Part 1            General**

**1.1                GENERAL REQUIREMENTS**

- .1        Wherever practical and reasonable, all cabinets and electrical boxes shall be installed in the locations shown on the attached floor plans.
- .2        Drawings show conduit connection requirements. Actual conduit runs shall run parallel to building lines.
- .3        Unless specified otherwise, all conduits shall be sized according to the number of cables in the run. Maximum conduit fill is 50%.
- .4        Unless specified otherwise, all junction boxes (J1, J2, J3, etc.) shall be steel and sized according to the number of conduits they must accommodate.
- .4        All conduits to the A6 backboard shall enter the room from the ceiling. Backboard space below the splitter trough(s) is reserved for PTSS equipment, see A6 backboard descriptions.
- .5        Unless noted otherwise, all cables pulled to the splitter trough in Room 101 shall have no less than 6000mm of cable slack in the splitter trough.
- .6        Unless noted otherwise, all cables pulled to the X2 cabinet in Room 200 shall have no less than 1200mm of cable slack in the cabinet.
- .7        Unless noted otherwise, all cables in a device or outlet box shall have no less than 600mm of cable slack at the device/outlet box.
- .8        All cables in a cabinet, a splitter trough, a device box, a utility box or an outlet box shall be labelled.
- .9        The contractor shall test all cables for opens, grounds and shorts. The contractor shall replace any cables found to be defective by the owner.

**Part 2            Execution**

**2.1                CONDUIT**

- .1        Unless specified otherwise, all conduits shall be EMT.

**2.2                JUNCTION, OUTLET AND PULL BOXES**

- .1        Unless specified otherwise, all outlet, device and pull boxes shall be steel.

**2.3                SPLITTER TROUGHS**

- .1        Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

**2.4                GROUND BAR**

- .1        Hoffman ASG8

**2.5                CABLE**

- .1        All telephone type (Cat3) cables shall be NORDX D-INSIDE CABLE, 24 AWG, CMR, Category 3 solid copper with a grey jacket (or equivalent).

- .2 All Category 5e (Cat5e) cables shall be Provo 24104L5E (or equivalent) with a white jacket.
- .3 All Category 6 (Cat6) cables shall be Provo 24104L6 (or equivalent) with a white jacket.
- .4 All LVT cables shall be four (4) conductor #18 solid AWG Standard Control LVT cable.
- .5 All coaxial cable shall be Provo 5911 (or equivalent).
- .6 All siamese cable shall be Provo 5934A (or equivalent).
- .7 All single pair shielded cable shall be Provo 7722 cable (or equivalent).
- .8 All 8 conductor overall shielded cable shall be Provo 6708 cable (or equivalent).
- .9 All 12 conductor overall shielded cable shall be Provo 6712 cable (or equivalent).
- .10 All multi-pair shielded cable shall be Provo 5402 (or equivalent).

## **2.6 PULL CORD/TAPE**

- .1 Polypropylene type, 200 lb tensile strength minimum.

## **Part 3 Execution**

### **3.1 A6 – SPLITTER TROUGH**

- .1 Supply and install one Hoffman AST4223R 1219W X 210H X 114Dmm Splitter Trough mounted 2400mm A.F.F..
- .2 All conduits to the A6 splitter trough shall enter the room **from the ceiling**.
- .3 Supply a Hoffman ASG8 Ground Bar, mounted on an insulator, inside the splitter trough. Bond to main building ground with a #6 AWG stranded, bare copper conductor.
- .4 Supply and install **five** 38mm conduits from the A6 splitter trough in Room 101 to the X1 cabinet in Room 100.
- .5 Supply, install and label **nine** Provo 5911 co-ax video cables (or equivalent) in each conduit from the splitter trough to the X1 cabinet (total of 45 coax cables).
- .6 Supply, install and label **five** Cat6 cables (or equivalent) in each conduit from this cabinet to the X2 cabinet (total of 25 Cat6 cables).
- .7 Supply and install one 25mm conduit between the A6 splitter trough and the telephone equipment backboard in the Mechanical Room.
- .8 Supply, install and label **one** 4 pair telephone (Cat3) cable and one Category 5e (Cat5e) cable in the conduit to the telephone equipment backboard. Cables shall have no less than 3000mm of slack at the telephone equipment backboard.
- .9 **The space below the A6 splitter trough in Room 101, is reserved for PTSS equipment. Do not run surface conduit in this area.**

**3.2 F1 – FIRE ALARM CONNECTION**

- .1 Supply and install conduit from the main fire alarm control panel to the A6 splitter trough.
- .2 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the main fire alarm control panel to the A6 splitter trough in Room 101. Leave 1200mm of cable slack inside the main fire alarm control panel.

**3.3 J7 – Junction Box**

- .1 Supply and install a junction box above the suspended ceiling. If the ceiling is finished the junction box should be flush mounted on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F. Junction box shall be sized according to the number of conduits that must be accommodated.
- .2 Supply and install conduit, sized to fit cables, from this junction box to the A6 splitter trough in room 101.

**3.4 T4 – “T” Cabinet (450H x 450W x 100D)**

- .1 Supply and install one recessed 450H X 450W X 100Dmm Type 1 Telephone cabinet mounted 150mm A.F.F.. **Recess mount the cabinet so that it remains accessible yet concealed by the Guard / Matron’s console.**
- .2 Supply and install a duplex 120VAC receptacle in the top left corner inside this cabinet (mount receptacle on the side of the cabinet not the back). This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).
- .3 Supply and install **two** 38mm conduits from this cabinet to the X2 cabinet in Room 200.
- .4 Supply, install and label **eleven** Provo 5911 co-ax video cables (or equivalent) in each conduit from this cabinet to the X2 cabinet (total of 22 coax cables).
- .5 Supply, install and label **five** Cat6 cables (or equivalent) in each conduit from this cabinet to the X2 cabinet (total of 10 Cat6 cables).

**Note:**

1. Supply no less than 3600mm of cable slack at the T4 cabinet.

**3.5 T7 – “T” Cabinet (300H x 300W x 100D)**

- .1 Supply and install one recessed 300H X 300W X 100Dmm Type 1 Telephone cabinet, complete with 3/4" wood back, centered 2250mm A.F.F..
- .2 Supply and install one duplex 120VAC receptacle in the top left corner inside this cabinet (mount receptacle on the side of the cabinet not the back). This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).
- .3 Supply and install one conduit from this cabinet to the X2 cabinet in Room 200.
- .4 Supply, install and label **three** 4 pair telephone (Cat3) cable(s) in the conduit from this cabinet to the X2 cabinet in Room 200.
- .5 Supply, install and label **three** 4 conductor **18 AWG** solid copper LVT cable(s) in the conduit from this cabinet to the X2 cabinet in Room 200.

**3.6 02 - Device Box**

- .1 Supply and install one recessed 4" square waterproof device box (2-1/8" deep) c/w blank cover plate. Mount device box 450mm below the rooftop (or as high as possible).
- .2 Supply and install conduit from this device to the A6 splitter trough in Room 101.
- .3 Supply, install and label **two** 4 pair telephone (Cat3) cables in the conduit from the outlet box to the A6 splitter trough in Room 101.

**3.7 04 Riot Alarm Horn**

- .1 Supply, install and connect one Edwards 874-G5 24VAC vibrating alarm horn (or equivalent) in a recessed 4" square outlet box mounted 100mm below finished ceiling but no higher than 2400mm A.F.F..
- .2 In the **MASTER UNIT**:
  - .1 Supply and install conduit from the 04 outlet box in Room 102 to the Riot Alarm Reset Pushbutton outlet box in Room 102.
  - .2 Supply, install and label **one** 4 conductor **18 AWG** solid copper LVT cable in the conduit from the 04 outlet box in Room 102 to the X1 cabinet in Room 100.
- .3 In the **BASE UNIT**:
  - .1 Supply and install conduit from the 04 outlet box in Room 206 to the T7 cabinet in Room 206.
  - .2 Supply, install and label **one** 4 conductor **18 AWG** solid copper LVT cable in the conduit from the 04 outlet box in Room 206 to the T7 cabinet in Room 206.

**3.8 11 Square Outlet Box**

- .1 Supply and have door-frame fabricator spot weld one 100 X 100 X **40**mm outlet box on top of the frame as per attached detail drawing "PROTECTED DOOR - ELEVATION OF SINGLE DOOR WITH DOOR CONTACT".
- .2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.
- .3 In the **MASTER UNIT**:
  - .1 Supply and install conduit from the outlet box in the door frame to the A6 splitter trough in Room 101.
  - .2 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the A6 splitter trough in Room 101.
- .4 In the **BASE UNIT**:
  - .1 Supply and install conduit from the outlet box in the door frame to the X2 cabinet in Room 200.
  - .2 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the X2 cabinet in Room 200.
  - .3 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

**3.9 21 Device Box**

- .1 Supply and install one recessed 100 X 150 X 63mm **three** gang device box c/w blank cover plate centered 1500mm A.F.F..



- .2 Supply and install conduit from this device box to the A6 splitter trough in Room 101.
- .3 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the device box to the A6 splitter trough in Room 101.

### 3.10 53 Riot Alarm Panic Pushbutton

- .1 Supply, install and connect one **red** 2.25" mushroom head "Square D" 9001KR25R momentary pushbutton with **two** "Square D" 9001KA2 normally open contact blocks and **one** "Square D" 9001K25 Flush Plate in a 100 X 50 X 63mm single gang device box (recess mounted and centered 1350mm A.F.F.).
- .2 In the **MASTER UNIT**:
  - .1 Supply and install conduit from the device box to the X1 cabinet in Room 100.
  - .2 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the device box to the X1 cabinet in Room 100.
- .3 In the **BASE UNIT**:
  - .1 Supply and install conduit from the device box to the T7 cabinet in Room 206.
  - .2 Supply, install and label **one** 4 pair telephone (Cat3) cable in the conduit from the device box to the T7 cabinet in Room 206.

### 3.11 73 Riot Alarm Reset Pushbutton

- .1 Supply, install and connect one **green** 60mm mushroom head "Square D" KR25R momentary pushbutton with one "Square D" KA2 normally open contact block in a recessed 100 X 50 X 63mm single gang device box mounted and centered 1500mm A.F.F..
- .2 Supply and install conduit from the device box to the X1 cabinet in Room 100.
- .3 Supply, install and label **two** 4 conductor **18 AWG** solid copper LVT cable in the conduit from the device box to the X1 cabinet in Room 100.

### 3.12 81 Octagon Outlet Box

- .1 Supply and install one recessed 4" octagon outlet box c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 300mm **above** the suspended ceiling.
- .2 In the **MASTER UNIT**:
  - .1 Supply and install conduit from the outlet to the A6 splitter trough in Room 101.
  - .2 Supply, install and label **one** Provo 5934A siamese cable (or equivalent) in the conduit from the outlet box to the A6 splitter trough in Room 101.
  - .3 Supply, install and label **one** Cat6 cable in the conduit from the outlet box to the A6 splitter trough in Room 101.
- .3 In the **BASE UNIT**:
  - .1 Supply and install conduit from the outlet to the X2 cabinet in Room 200.
  - .2 Supply, install and label **one** Provo 5934A siamese cable (or equivalent) in the conduit from the outlet box to the X2 cabinet in Room 200.
  - .3 Supply, install and label **one** Cat6 cable in the conduit from the outlet box to the X2 cabinet in Room 200.

**3.13 86 Device Box**

- .1 Supply and install one recessed 4" square waterproof device box (2-1/8" deep) c/w blank weatherproof cover plate. Mount device box 450mm below the rooftop (or as high as possible).
- .2 Supply and install conduit from this device box to the A6 splitter trough in Room 101.
- .3 Supply, install and label **one** Provo 5934A siamese cable (or equivalent) in the conduit from the device box to the A6 splitter trough in Room 101.
- .4 Supply, install and label **one** Cat6 cable in the conduit from the device box to the A6 splitter trough in Room 101.

**3.14 91 Device Box**

- .1 Supply and install one recessed 100 X 50 X 63mm single gang device box c/w blank cover plate centered 1400mm A.F.F..
- .2 Supply and install conduit from this device box to the J7 junction box in Room 108.
- .3 Supply, install and label **one** Provo 7722 cable (or equivalent) in the conduit from the device box to the A6 splitter trough in Room 101.

**3.15 X1 Cabinet (900H X 600W X 150D)**

- .1 Supply and install one recessed 900H X 600W X 150Dmm Type 1 Telephone cabinet, complete with 3/4" wood back, centered 1500mm A.F.F..
- .2 Supply and install **four** 50mm conduits from this cabinet to the wall mounted cable tray located just below the X1 cabinet.

**3.16 X2 Cabinet (900H X600W X 150D)**

- .1 Supply and install one recessed 900H X 600W X 150Dmm Type 1 Telephone cabinet, complete with 3/4" wood back, centered 1500mm A.F.F..
- .2 Supply and install **four** 50mm conduits from this cabinet to the wall mounted cable tray located just below the X2 cabinet.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 26 05 00 - Common Work Results - Electrical.

**1.2                REFERENCES**

- .1            Government of Canada
  - .1            NBC-2005, National Building Code of Canada.
  - .2            TB OSH Chapter 3-03, 1997-01-28, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire Protection Electronic Data Processing Equipment.
  - .3            TB OSH Chapter 3-04, 1994-12-22, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.
- .2            Underwriter=s Laboratories of Canada (ULC)
  - .1            CAN/ULC-S524-06, Installation of Fire Alarm Systems.
  - .2            CAN/ULC-S525-07, Audible Signal Appliances for Fire Alarm.
  - .3            CAN/ULC-S526-07, Visual Signal Devices for Fire Alarm Systems, Including Accessories.
  - .4            CAN/ULC-S527-99, Standard for Control Units for Fire Alarm Systems.
  - .5            CAN/ULC-S528-05, Manual Stations for Fire Alarm Systems, Including Accessories.
  - .6            CAN/ULC-S529-02, Smoke Detectors for Fire Alarm Systems.
  - .7            CAN/ULC-S530-1991, Heat Actuated Fire Detectors for Fire Alarm Systems.
  - .8            CAN/ULC-S531-02, Standard for Smoke Alarms.
  - .9            CAN/ULC-S536-04, Inspection and Testing of Fire Alarm Systems.
  - .10          CAN/ULC-S537-04, Verification of Fire Alarm Systems.
  - .11          CAN/ULC-S541-07, Speakers for Fire Alarm Systems, Including Accessories.
- .3            CAN/CSA-C22.1-2009, Canadian Electrical Code
- .4            In the case of any discrepancy between these specifications, the project drawings, and any applicable local codes, the installed Fire Alarm / Life Safety System shall comply with the most stringent requirement.

**1.3                SYSTEM DESCRIPTION**

- .1            Fully supervised, addressable, Class A, microprocessor based, fire alarm system, utilizing digital techniques for data control and digital and multiplexing techniques for data transmission.
- .2            System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency.
- .3            Zoned, non-coded, single stage.

- .4 Modular in design to allow for future expansion.
- .5 Operation of system shall not require personnel with special computer skills.
- .6 System to include:
  - .1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.
  - .2 Trouble signal devices.
  - .3 Power supply facilities.
  - .4 Manual alarm stations.
  - .5 Automatic alarm initiating devices.
  - .6 Audible signal devices.
  - .7 End-of-line devices.
  - .8 Annunciators.
  - .9 Visual alarm signal devices.
  - .10 Ancilliary devices. Spare contacts for autodialers, door hold opens, air handling units, etc.
  - .11 Device loop isolation modules.

#### **1.4 REQUIREMENTS OF REGULATORY AGENCIES**

- .1 System:
  - .1 To TB OSH Chapter 3-04.
  - .2 Subject to Fire Commissioner of Canada (FC) approval.
  - .3 Subject to FC inspection for final acceptance.
- .2 System components: listed by ULC and comply with applicable provisions of National Building Code and Local/Provincial Building Codes, and meet requirements of local authority having jurisdiction.

#### **1.5 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance Section 26 05 00 - Common Work Results - Electrical.
- .2 Include:
  - .1 Layout of equipment.
  - .2 Zoning.
  - .3 Complete wiring diagram, including schematics of modules.
  - .4 Complete system riser diagram identifying control equipment, initiating zones, loop isolation modules and signaling circuits.
  - .5 Shop drawings to be stamped by manufacturer to ensure equipment and design are in accordance with ULC standards

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**1.6 QUALITY ASSURANCE**

- .1 Qualifications: Installation to be performed by a qualified licensed Electrical Contractor and licensed journeyman electrician.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .2 Components and control panels to be factory assembled and tested.
- .3 Installation to be supervised by manufacturer's representative with three (3) or more years of experience in fire alarm systems. This person shall be responsible for the following:
  - .1 On-site visits:
    - .1 Prior to installation to ensure that the Contractor is familiar with all aspects of installation.
    - .2 During installation to confirm wiring compliance.
    - .3 After installation is complete to verify that system is fully operational and working in accordance with design.
  - .2 Start-up, demonstration and training in accordance with Section 26 05 00: Common Work Results for Electrical.
    - .1 Conduct training program for designated building personnel to allow system users to understand and exercise all aspects of system operation.
    - .2 Troubleshooting basics.
  - .3 Training duration: 2 hours.
  - .4 Manufacturer's Field reports: Submit to Engineer or Consultant, a written report, within 3 days of review for each visit, verifying compliance of Work, test results, and product installation in accordance with manufacturer's and supervisors' recommendations.

**1.7 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for fire alarm system for incorporation into manual specified in Section 26 05 00 - Common Work Results - Electrical.
- .2 Include:
  - .1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
  - .2 Technical data - illustrated parts lists with parts catalogue numbers.
  - .3 Copy of approved shop drawings.
  - .4 List of recommended spare parts for system.
  - .5 Certificate of Verification.
  - .6 Installer to provide fire alarm risers and building plan drawings as described in Section 26 05 00 - Common Work Results - Electrical.

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**1.8 MAINTENANCE**

- .1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Owner Engineer.
- .2 Provide individual price on tender form for temporary program changes during construction period, to include zone labels, control functions, system operation.

**1.9 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Power supply: to CAN/ULC-S524.
- .3 Audible signal devices: to ULC-S525.
- .4 Visual signal devices: to CAN/ULC-S526.
- .5 Control unit: to CAN/ULC-S527.
- .6 Manual pull stations: to CAN/ULC-S528.
- .7 Thermal detectors: to CAN/ULC-S530.
- .8 Smoke detectors: to CAN/ULC-S529.
- .9 Smoke alarms: to CAN/ULC-S531.
- .10 Any equipment not bearing a ULC Label shall be removed and replaced with compatible ULC labeled equipment at the contractor's expense.

**2.2 SYSTEM OPERATION: SINGLE STAGE**

- .1 Actuation of any alarm initiating device to:
  - .1 Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder.
  - .2 Indicate address of alarm and zone partition at central control unit and remote annunciator if applicable.
  - .3 Cause audible signalling devices to sound continuously throughout building and at central control unit.

- .4 Transmit signal to fire department via central station.
- .5 Cause air conditioning and ventilation fans to shut down or to function to provide required control of smoke movement as required.
- .6 Cause fire doors and smoke control doors, if normally held open, to close automatically.
- .2 Acknowledging alarm: indicated at central control unit.
- .3 Possible to silence signals by "alarm silence" switch at control unit, after 60s period of operation.
- .4 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.
- .5 Actuation of supervisory devices to:
  - .1 Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.
  - .2 Indicate respective supervisory zone at central control unit and at remote annunciator if applicable.
  - .3 Cause audible signal at central control unit to sound.
  - .4 Activate common supervisory sequence.
- .6 Resetting alarm, supervisory device not to return system indications/functions back to normal until control unit has been reset.
- .7 Trouble on system to:
  - .1 Indicate circuit in trouble at central control unit.
  - .2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; whereas visual indication to remain until trouble is cleared and system is back to normal.
- .8 Trouble on system: suppressed during course of alarm.
- .9 Trouble condition on any circuit in system not to initiate alarm conditions.

## 2.3 CONTROL PANEL

- .1 Central control unit (CCU).
  - .1 Suitable for DCLA communication style: to CAN/ULC-S524.
  - .2 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.
  - .3 Minimum capacity of 250 addressable monitoring and 250 addressable control/signal points. Points may be divided between 2 communication channels in distributed system, each channel operating independently of other. Faults on one communication channel not to affect operation of other channel.
  - .4 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.
  - .5 Integral power supply, battery charger and standby batteries.

- .6 Basic life safety software: retained in non volatile Erasable Programmable Read-Only-Memory (EPROM). Extra memory chips: easily field-installed. Random-Access-Memory (RAM) chips in panel to facilitate password-protected field editing of simple software functions (e.g. zone labels, priorities) and changing of system operation software.
- .7 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.
- .8 Communication between CCU and remote addressable devices to be supervised, DCLA. Should communications fail between CCU and remote units, audible and visual trouble to be indicated at CCU. Data communication to be binary DC, baseband, time-division multiplex, half-duplex. Each data channel: capable of communicating up to distance of 3,000 m.
  - .1 Communication between nodes in networked system to be supervised, DCLA. Should communications fail between any 2 nodes, other nodes on loop to continue to communicate with each other and programmed functions on communicating nodes to continue operating.
- .9 Support up to 2 RS-232-C I/O ports. CCU output: parallel ASCII with adjustable baud rates to allow interface of any commercially available printer, terminal or PC.
- .10 Equipped with software routines to provide Event-Initiated-Programs (EIP); change in status of one or more monitor points, may be programmed to operate any or all of system's control points.
- .11 Software and hardware to maintain time of day, day of week, day of month, month and year.
- .12 Software to operate variable sensitivity addressable smoke detectors and announce their status and sensitivity settings at control panel.
- .2 Enclosure: Sprinkler proof as per 26-008, CSA-C22.1-09 c/w lockable concealed hinged door, full viewing window, flush lock and 2 keys.
- .3 Standard of acceptance: General Electric, Notifier or Simplex.

#### **2.4 DATA GATHERING PANELS (DGP'S)/TRANSPONDERS**

- .1 Fire control modules: distributed throughout building in separately enclosed units (DGPS) and interconnected to central control unit utilizing multiplex data transmission techniques.
- .2 Addressable DGP's.
  - .1 DGP's: addressable type, provide two-way data communication with addressable devices/interface modules, utilizing digital poll/response protocol communication format. Each addressable device: uniquely identified by own address, set at time of installation.
  - .2 Addressable DGP's: stand-alone capability.
  - .3 Interface modules: facilitate connection of non-addressable devices (e.g. flow switch) to addressable DGP; provided in different types for connection to monitoring devices (e.g. flow/tamper switch), signalling devices (e.g. bells, horns), and control functions (e.g. fan shutdown, door release); communicate with addressable DGP over minimum number of wires (specified by manufacturer).



- .4 Possible to connect all 3 types of addressable interface modules (monitoring, signal and control) to same addressable communication loop.
- .5 Addressable DGP's: self-contained, as specified.
- .6 Possible to connect variable-sensitivity addressable smoke detectors together with other addressable devices to same addressable communication loop.

## **2.5 POWER SUPPLIES**

- .1 120 V, 60 Hz as primary source of power for system.
- .2 Voltage regulated, current limited distributed system power.
- .3 Primary power failure or power loss (less than 102 V) will activate common trouble sequence.
- .4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.
- .5 During normal operating conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.
- .6 Standby batteries: sealed, maintenance free with a minimum expected life of 5 years, sized to operate system under supervisory load conditions without recharging for 24 consecutive hours and have sufficient power left to operate sounding devices for 30 minutes. Battery bank and charger to be integrally mounted in main fire alarm control panel.
- .7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

## **2.6 INITIATING/ INPUT CIRCUITS**

- .1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors and water flow switches, wired in DCLA configuration to central control unit or DGP's/transponders.
- .2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.
- .3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".
- .4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLA configuration to central control unit or DGP's/transponders.
- .5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

## **2.7 ALARM OUTPUT CIRCUITS**

- .1 Alarm output circuit: connected to signals, wired in class B configuration to central control unit.

- .1 Signal circuits' operation to follow system programming; capable of sounding bells and driving strobe lights continuously. Each signal circuit: rated at 2 A, 24 VDC; fuse-protected from -overloading/overcurrent.
- .2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

## **2.8 AUXILIARY CIRCUITS**

- .1 To shut down the Air Handling Unit fans.
- .2 To automatically close fire doors and smoke control doors, if normally held open.
- .3 Actual status indication (positive feedback) from controlled device.
- .4 Alarm and supervisory on system to cause operation of programmed auxiliary output circuits.
- .5 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.
- .6 Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system. Timing circuit: controlled by CCU.
- .7 Auxiliary circuits: rated at 2 A, 24 V dc or 120 V ac, fuse-protected.

## **2.9 WIRING**

- .1 In accordance with Section 26 05 21 – Wires and Cables (0 – 1000V).
- .2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.
- .3 To signal circuits: 10 AWG minimum, and in accordance with manufacturer's requirements.
- .4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

## **2.10 MANUAL ALARM STATIONS**

- .1 Addressable manual pull station.
  - .1 Pull lever, break glass rod, semi-flush wall mounted type, single action, single stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.

## **2.11 AUTOMATIC ALARM INITIATING DEVICES**

- .1 Addressable heat detectors, fixed temperature , non-restorable rated 57 or 93 C.
  - .1 Electronics to communicate detector's status to addressable module/transponder.
  - .2 Detector address to be set on detector base in field.

- .2 Addressable smoke detector.
  - .1 Ionization type.
  - .2 Electronics to communicate detector's status to addressable module/transponder.
  - .3 Detector address to be set on detector base in field.
- .3 Addressable duct smoke detector.
  - .1 Photo-electric air duct type with sampling tubes and protective housing.
  - .2 Twist-in type with fixed base.
  - .3 Wire-in base assembly with integral red alarm LED and terminals for remote relay alarm LED.
  - .4 Electronics to communicate detector's status to addressable module/transponder.
  - .5 Detector address to be set on detector base in field.

## **2.12 FIELD DEVICE PROTECTIVE CAGES**

- .1 To be installed over smoke detectors in cells.
- .2 Standard of Acceptance:
  - .1 Edwards 6255-004: rotate conduit entrance cover 90 degrees to ensure no opening exists when installed. Cover only to be used in air velocities greater than 9 meters per minute as a condition of ULC approval.
  - .2 Simplex 2098-9829C: rotate guard so that conduit port is blocked by the perforated tab on the mounting plate. Cover only to be used in air velocities greater than 3 meters per minute as a condition of ULC approval.
  - .3 Notifier Guard Model Smoke G1A-2.
  - .4 All grills/protective cages must be stamped with manufacturer and model # on face plate.

## **2.13 AUDIBLE SIGNAL DEVICES**

- .1 Combination Horn/Strobe:
  - .1 Red fire alarm horns of the enclosed mounting type with heavy duty mechanisms to provide 87 dB@ 10 feet. Polarize the horns for supervised operations. Use flush box, surface mounting as applicable.
  - .2 Wedge shaped strobes clearly labeled Fire. Polarize the strobes for supervised operation. Strobes shall provide a high intensity flashing light for visual signaling. Mount the units as with the Horns.

## **2.14 END-OF-LINE DEVICES**

- .1 End-of-line devices to control supervisory current in signaling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

## **2.15 REMOTE ANNUNCIATORS**

- .1 LCD type, with designation cards to indicate zones.

- .2 Display:
  - .1 Alarms and troubles for alarm initiating circuits.
  - .2 Common supervisory alarm for supervisory initiating circuits.
  - .3 Common system trouble.
- .3 Trouble buzzer.
  - .1 Acknowledging trouble at main panel to silence trouble buzzers in system.
- .4 Supervised, with LED test button and alarm trouble acknowledge button.
- .5 Minimum wiring configuration with main panel.

## **2.16 AS-BUILT RISER DIAGRAM**

- .1 Fire alarm system riser diagram: in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Locate in main electrical room, and provide a paper copy in the Operation and Maintenance Manual.

## **2.17 ANCILLARY DEVICES**

- .1 Remote relay unit to initiate fan shutdowns.
- .2 Remote relay unit to initiate automatic door closers, and release maglocks if applicable.

## **2.18 ISOLATOR MODULES**

- .1 Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on a Class A branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the loop segment or branch. Isolators are to be located as specified herein and where shown on the drawings.
- .2 If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the signaling line circuit. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- .3 The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
- .4 Isolator modules to be installed as per ULC-S524-01 and are to be located between the fire alarm zones as indicated in the zoning schedule on the drawings.

## **2.19 SPRINKLER SYSTEM**

- .1 Connect all sprinkler flow switches to the respective box circuits wired to sound alarm in the event of the sprinkler's operation.
- .2 Connect all sprinkler gate valve(s) to sound trouble if the valve is closed. Gate valves to be wired to a supervisory circuit such that signaling trouble will not prevent an initiating device from sending an alarm signal to the fire alarm panel.

- .3 Sprinkler supervised valve switches, and flow switches to be provided by Mechanical Contract.
- .4 Refer to mechanical shop drawings for locations prior to rough-in.
- .5 Provide multiplexing modules at each sprinkler device location to allow individual addressing of device on to fire alarm system supervisory loop.

## **2.20 SIGNALS TO FIRE DEPARTMENT**

- .1 Notification of fire department shall be provided in accordance with CAN/ULC-S536.
- .2 Provide autodialer/communicator for reporting alarm and trouble conditions to a remote monitoring station conforming to the requirement.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install systems in accordance with CAN/ULC-S524 and Canadian Electrical Code Section 32.
- .2 Install main control panel and connect to ac power supply, dc standby power.
- .3 Locate and install manual alarm stations and connect to alarm circuit wiring.
- .4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .5 All fire alarm wiring shall be in conduit. The contractor shall be responsible for the supply and installation of the conduit, wire, wire pulling, junction boxes, electrical boxes, and terminal cabinets in accordance with the manufacturers recommendations.
- .6 The manufacturer shall allow for the necessary amount of on site assistance for the contractor during the construction period.
- .7 Locate and install horns, bells, and visual signal devices and connect to signaling circuits. Mount horn/strobe units as per Section 26 05 00 or as per interior elevations.
- .8 Connect alarm circuits to main control panel.
- .9 Connect signaling circuits to main control panel.
- .10 Install end-of-line devices at end of signaling circuits.
- .11 Install remote annunciator panels and connect to annunciator circuit wiring.
- .12 Locate and install door releasing devices.
- .13 Locate and install remote relay units to control fan shut down.

- .14 Sprinkler system: wire alarm and supervisory switches and connect to control panel..

### 3.2 SYSTEM VERIFICATION

- .1 Fire alarm equipment supplier to make a thorough inspection of the complete installed fire alarm system including all components such as manual stations, thermal detections, products-of-combustion detectors, and controls to ensure the following:
- .1 System is complete and functional in accordance with engineer's specifications.
  - .2 System is installed according to Underwriters Lab of Canada S524 requirements.
  - .3 System is installed in accordance with manufacturer's recommendations.
  - .4 Regulations covering supervision of components are adhered to.
  - .5 Subsequent changes necessary to conform to Items 1, 2, 3 and/or 4 to be done by Division 26 with technical assistance supplied by the manufacturer.
  - .6 During the period of this inspection by the manufacturer, Division 26 to supply to the manufacturer one journeyman electrician.
  - .7 To assist Division 26 in preparing his bid, manufacturer to specify number of hours required to perform this inspection.
  - .8 Manufacturer to submit to engineer on completion of inspection a point-by-point check list indicating date and time of each item inspected and also issue a Certificate for his records confirming that inspection has been completed and system is installed and functioning in accordance with the specifications. Included with this Certificate to be satisfactory proof of liability insurance valid for not less than one (1) year from date of final inspection.
  - .9 Certificate to be free from defining and qualified statements which would make it unacceptable by the Owner.
  - .10 Provide a copy of the inspecting technician's report. Identify each device by location and certify the test results.
  - .11 Verification shall take place no later than 1 week prior to the substantial completion date. Notify Consultant of verification date and time at least one week in advance.
  - .12 Verification may be performed only after:
    - .1 Air balancing is complete.
    - .2 Sprinkler system is 100% complete, charged and ready for use.
    - .3 Building is at a state of completion that will ensure a reasonably dust free environment and the absence of contaminating fumes from verification date to final completion.
  - .13 Manufacturer to provide sufficient backup parts on site during verification to accommodate any component failures. Backup parts not used during verification can be removed from site by the manufacturer.
  - .14 Provide all testing equipment required for testing smoke detectors and heat detectors during verification.
  - .15 Issue a Certificate of Verification confirming the completion of the verification.
  - .16 Remuneration shall be paid to the design Consultant to be onsite for the Verification of Fire Alarm. Include all costs of this Verification inspection in the total tender price.

- .2 Provide all testing equipment required for testing smoke detectors and heat detectors during verification.
- .3 The manufacturer shall report to the Consulting Engineer after the installation meets all of the above conditions.
- .4 Provide a copy of the inspecting technician's report. Identify each device by location and certify the test results.
- .5 Issue a Certificate of Verification confirming the completion of the verification.
- .6 Include all costs of this Verification inspection in the total tender price.

### **3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results – For Electrical and CAN/ULC-S537.
- .2 Fire alarm system:
  - .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors sprinkler system transmit alarm to control panel and actuate first stage alarm general alarm ancillary devices.
  - .2 Check annunciator panels to ensure zones are shown correctly.
  - .3 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of trouble signals.
  - .4 Addressable circuits system style DCLA:
    - .1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
    - .2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
  - .5 Provide final control panel programming for system Engineer incorporating program changes made during construction.
  - .6 Simulate and test all auxiliary functions.
- .3 Test to be performed by the system manufacturer or qualified testing company, certified to test fire alarm system within the Province or Territory of building installation

**END OF SECTION**

4 3 2 1

B

# ROYAL CANADIAN MOUNTED POLICE

## Hollow Metal Door & Pressed Steel Frame Shop Drawings

A

**Project:** SLIDING AND SWINGING CELL DOORS  
LEVEL 3 NAAMM 863-98 ASTM F1450-97 PERFORMANCE CRITERIA

**Prepared By:** CATRIONA L JOHNSON

**Date:** SEPTEMBER 26, 2007

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AND MUST BE RETURNED ON DEMAND.

**FINAL**

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4

3

2

1

**GENERAL NOTES: PLEASE READ**

1) FABRICATION OF HOLLOW METAL DOORS & FRAMES WILL NOT COMMENCE UNTIL THE FOLLOWING IS RECEIVED:

A) APPROVED HARDWARE SCHEDULE

C) ALL NECESSARY HARDWARE TEMPLATES

NOTE: LEAD TIMES VARY SO THIS INFORMATION IS CRITICAL

2) THESE DRAWINGS ARE FOR THE RCMP USE ONLY. RCMP WILL NOT ACCEPT ANY RESPONSIBILITY DUE TO ERRORS CAUSED BY THE USE OF THESE DRAWINGS BY OTHER TRADES.

3) DOORS AND FRAMES TO BE REINFORCED FOR SURFACE MOUNTED HARDWARE AS REQUIRED. DRILLING AND TAPPING FOR ATTACHING OF SURFACE MOUNTED HARDWARE BY OTHERS. DOORS AND FRAMES WILL BE BLANKED, REINFORCED, DRILLED AND TAPPED FOR MORTISED TEMPLATED HARDWARE. TRIM MOUNTING HOLES AND ALL HOLES Ø1/2" [13 mm] & LESS, BY OTHERS.

4) MAXIMUM ALLOWABLE DISTANCE BETWEEN THE SLIDING DOOR AND THE FRAME MUST BE LIMITED TO 1/8" [3 mm]. FIELD SHIMMING MAY BE REQUIRED ON SITE BY THE INSTALLATION CONTRACTOR TO OBTAIN THE DESIRED CLEARANCES.

5) ALL DOORS AND FRAMES TO BE MARKED WITH THE DOOR MANUFACTURER'S NAME AND PRODUCT NUMBER ON THE SECOND HINGE FROM THE TOP UNLESS SPECIFIED OTHERWISE.

6) ALL HOLLOW METAL FRAMES SHALL BE OF WELDED CONSTRUCTION UNLESS NOTED OTHERWISE.

7) ALL SWING TYPE FRAMES TO BE PREPARED FOR PUSH-IN TYPE SILENCERS, 3 PER STRIKE JAMB FOR SINGLE FRAMES OR 2 PER HEAD FOR DOUBLE FRAMES.

8) ALL HARDWARE LOCATIONS ON THE DOORS & FRAMES TO BE AS PER THE FOLLOWING DRAWINGS, UNLESS ADVISED OTHERWISE.

9) GENERAL CONTRACTOR IS RESPONSIBLE TO ENSURE THAT FRAMES AND DOORS ARE SET PLUMB, SQUARE, LEVEL AND THAT WALLS AND FRAME ARE FULLY GROUTED. THE MANUFACTURER OF HOLLOW METAL DOORS AND/OR PRESSED STEEL FRAMES CAN NOT CONTROL THE QUALITY OF EITHER THE HARDWARE, THE FIELD INSTALLATION OF HARDWARE, OR THE PROPER ERECTION OF FRAMES IN THE WALL.

10) ALL BURRS AND SHARP EDGES MUST BE REMOVED AFTER INSTALLATION.

11) THE FOLLOWING SHOP DRAWINGS REFLECT A STANDARD 195 mm BLOCK WALL CONSTRUCTION, SITE CONDITIONS MAY VARY.

REVISIONS:

REVISION AS PER THE MEETING ON JULY 20, 2006

NOTES:

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**FINAL**

JOB:

CONTRACTOR:

DRAWN BY:  
CL JOHNSON

DATE:  
9/26/2007

W.O.#:

FILE NUMBER:

PG.#:

2

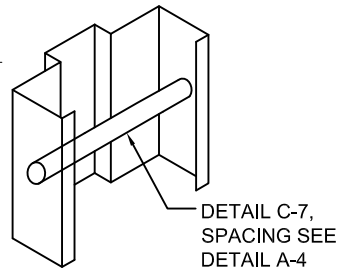
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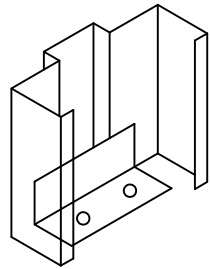
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**A-3 ANCHOR TYPES**

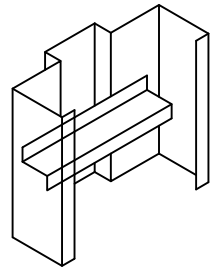


WELDED ROD ANCHOR

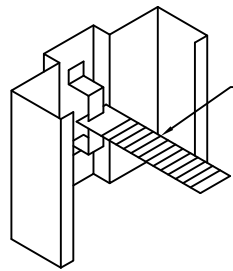
DETAIL C-7,  
SPACING SEE  
DETAIL A-4



STANDARD FIXED  
BASE ANCHOR

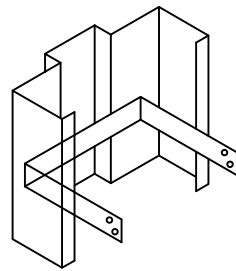


STEEL STUD  
ANCHOR

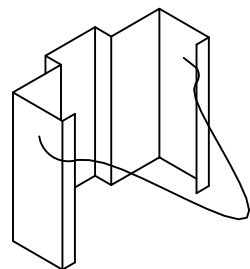


CORRUGATED TAIL  
ANCHOR

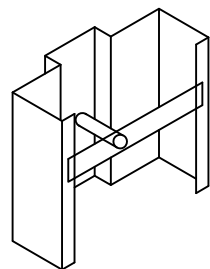
DETAIL B-7



WOOD STUD  
ANCHOR



CONCRETE BLOCK WALL  
WIRE ANCHOR



EXISTING WALL  
ANCHOR

**B-3 DOOR AND FRAME HANDING CHART  
TO DETERMINE HAND(SWING) OF DOOR AND FRAME  
STAND OUTSIDE - FACING DOOR**

<p>INSIDE</p> <p>OUTSIDE RIGHT HAND</p>	<p>INSIDE</p> <p>OUTSIDE LEFT HAND</p>
<p>INSIDE</p> <p>OUTSIDE RIGHT HAND REVERSE</p>	<p>INSIDE</p> <p>OUTSIDE LEFT HAND REVERSE</p>
<p>INSIDE INACTIVE</p> <p>OUTSIDE PAIR OF DOORS LH ACTIVE</p>	<p>INSIDE INACTIVE</p> <p>OUTSIDE PAIR OF DOORS RH ACTIVE</p>
<p>INSIDE INACTIVE</p> <p>OUTSIDE PAIR OF DOORS LHR ACTIVE</p>	<p>INSIDE INACTIVE</p> <p>OUTSIDE PAIR OF DOORS RHR ACTIVE</p>

\* KS IS THE KEY SIDE OF DOOR (PLEASE CHECK ALL SWINGS TO ENSURE KEY IS ON PROPER SIDE OF DOOR)

**FIRE RATING LABELS**

- A - 3 HOUR
- B - 1 1/2 HOUR
- C - 45 MINUTE
- 20M - 20 MINUTE

**DOOR MATERIALS**

- HM - HOLLOW METAL DOOR - HONEYCOMB
- IHM - INSULATED HOLLOW METAL DOOR - POLYSTYRENE
- SLH - STEEL STIFFENED (LAMINATED-HONEYCOMB)
- SLP - STEEL STIFFENED (LAMINATED-POLYSTYRENE)
- SWF - STEEL STIFFENED (WELDED-FIBREGLASS)
- SCW - SOLID CORE WOOD DOOR
- HCW - HOLLOW CORE WOOD DOOR
- PLM - PLASTIC LAMINATED

**REMOVABLE STOPS**

- PL - PULL SIDE OF DOOR
- PS - PUSH SIDE OF DOOR

**ANCHOR TYPES**

- SS - STEEL STUD ANCHOR
- CT - CORRUGATED TAIL ANCHOR
- WS - WOOD STUD ANCHOR
- EWA - EXISTING WALL ANCHOR
- CB - CONCRETE BLOCK WIRE ANCHOR
- BA - BASE ANCHOR
- WR - WELDED ROD ANCHOR

**HARDWARE**

- PP - PUSH & PULL
- RIM - RIM PANIC
- VR - VERTICAL ROD
- FB - FLUSH BOLT
- R/F - REINFORCE
- CVR - CONCEALED VERTICAL ROD

**DOOR SWINGS**

- LH - LEFT HAND
- LHR - LEFT HAND REVERSE
- RH - RIGHT HAND
- RHR - RIGHT HAND REVERSE

**REVISIONS:**

REVISION AS PER THE MEETING ON JULY 20, 2006

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CONTRACTOR:

DRAWN BY:  
CL JOHNSON

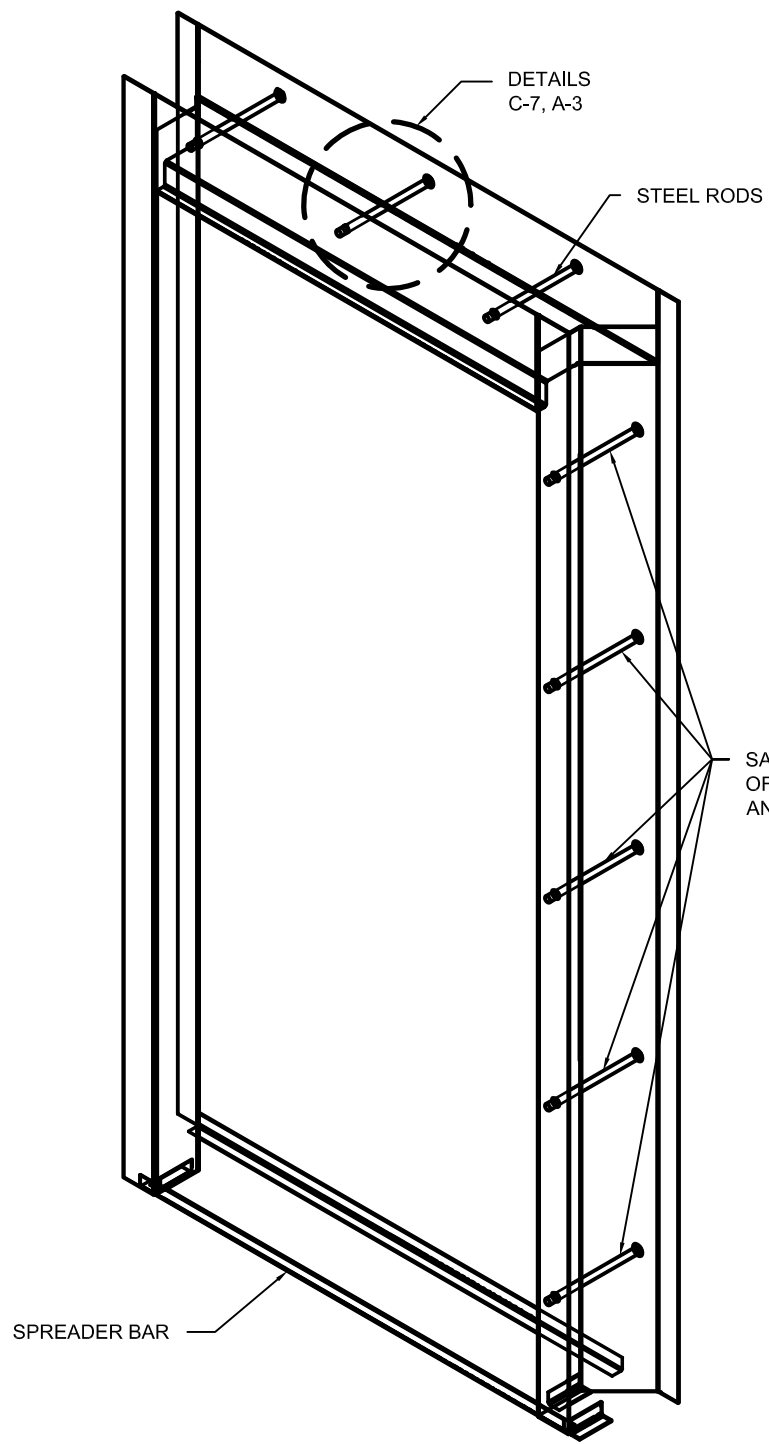
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9/26/2007

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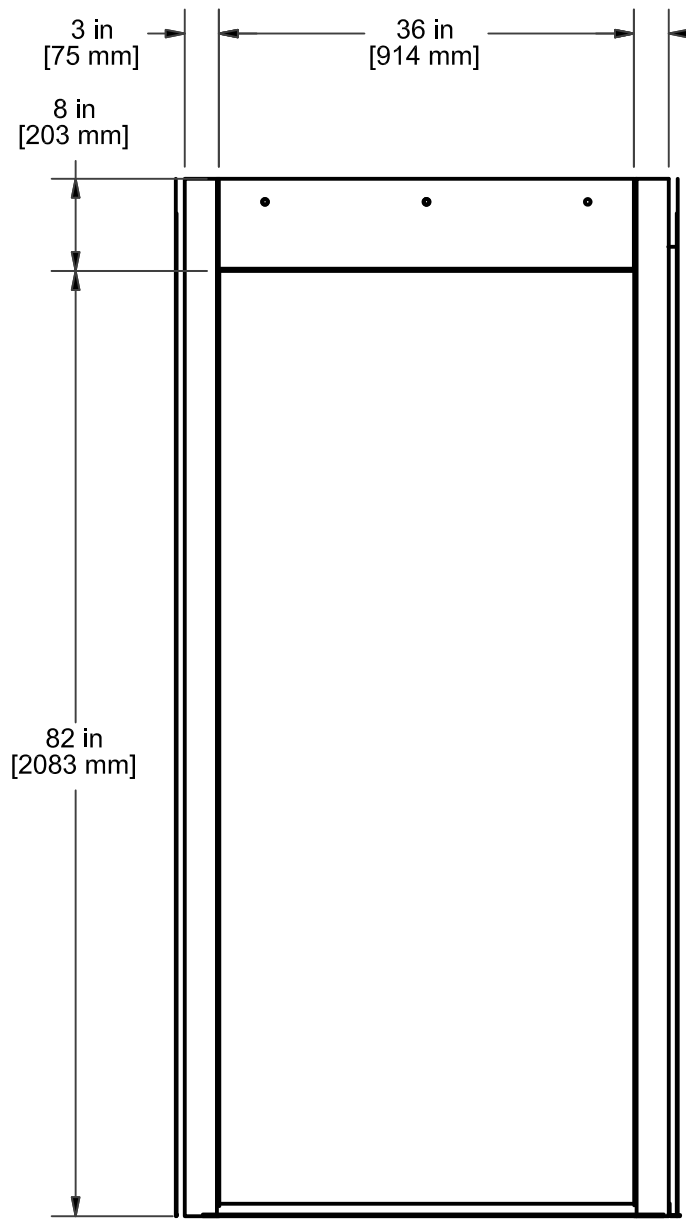
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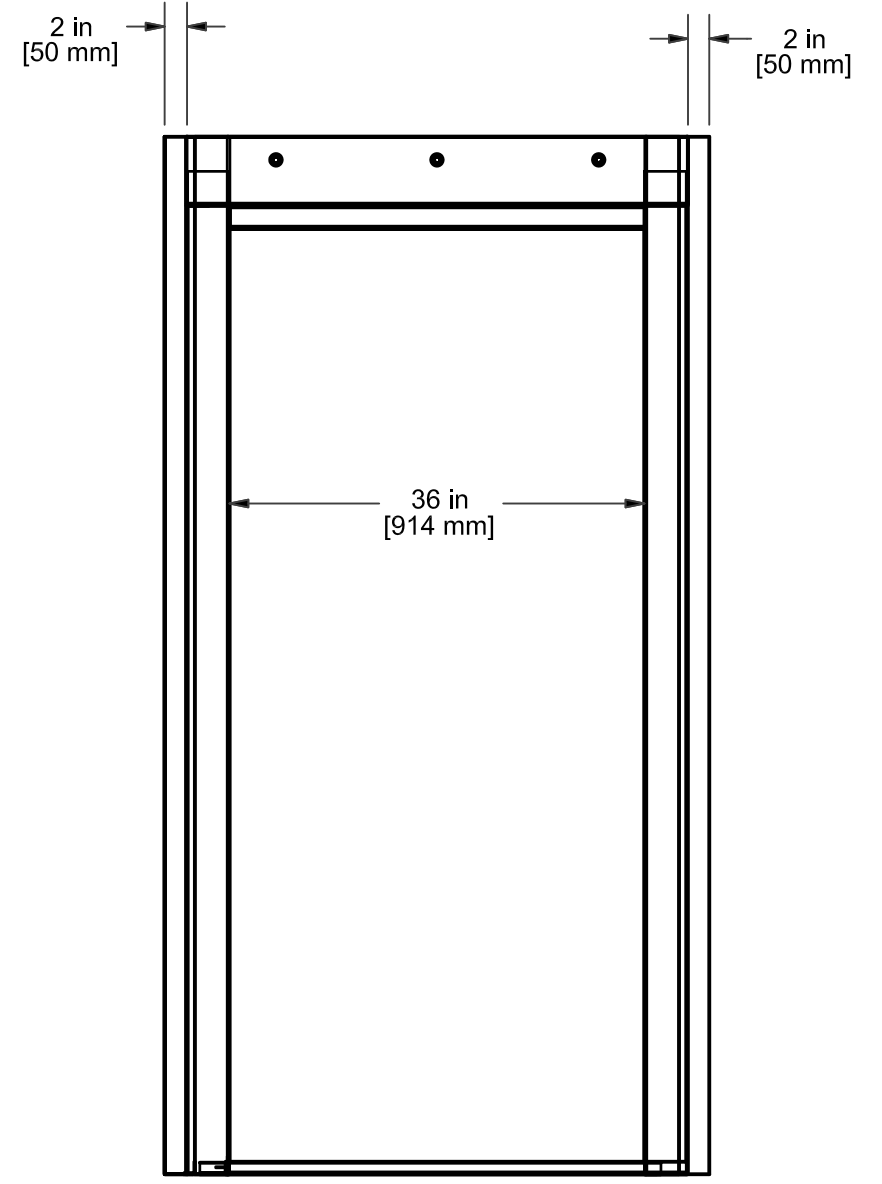
# 12GA. FRAME FOR SLIDING DOOR



**A-4 ISOMETRIC VIEW**



**B-4 CORRIDOR SIDE**



**C-4 DETAINEE SIDE**

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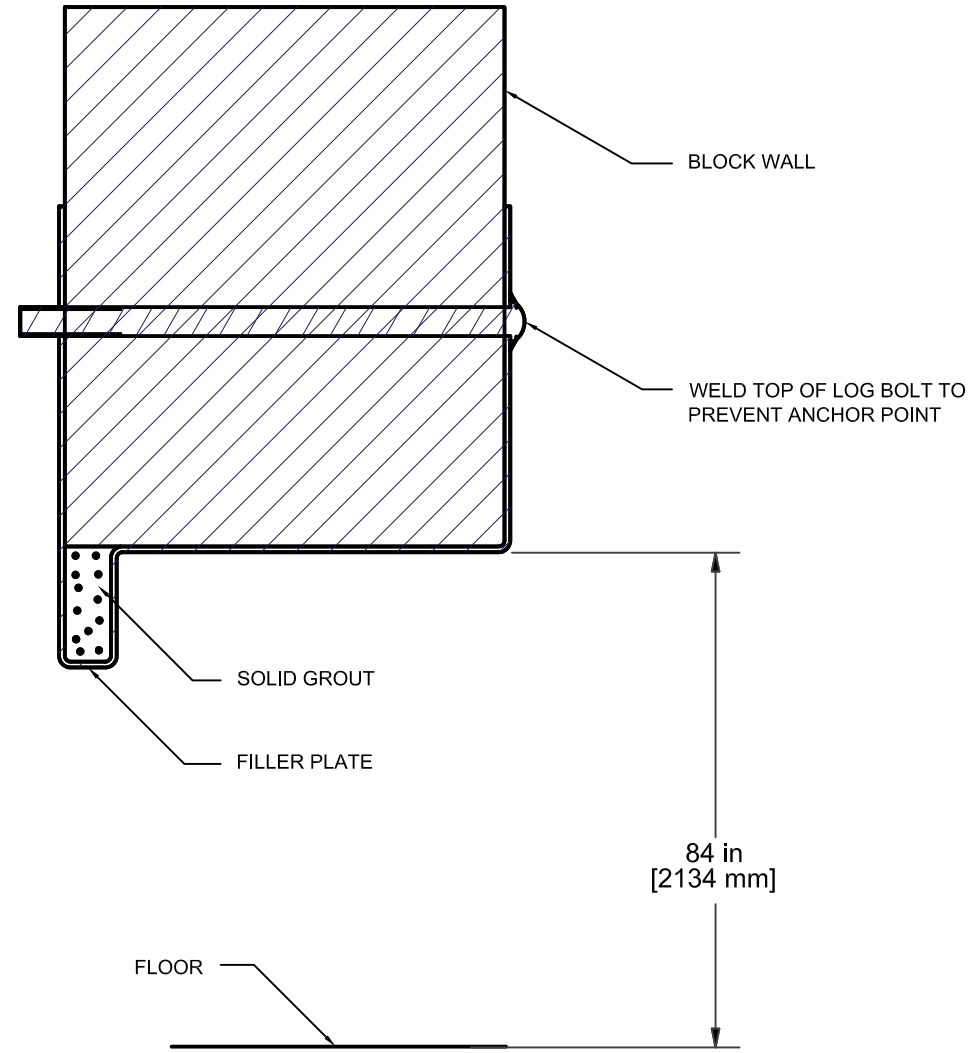
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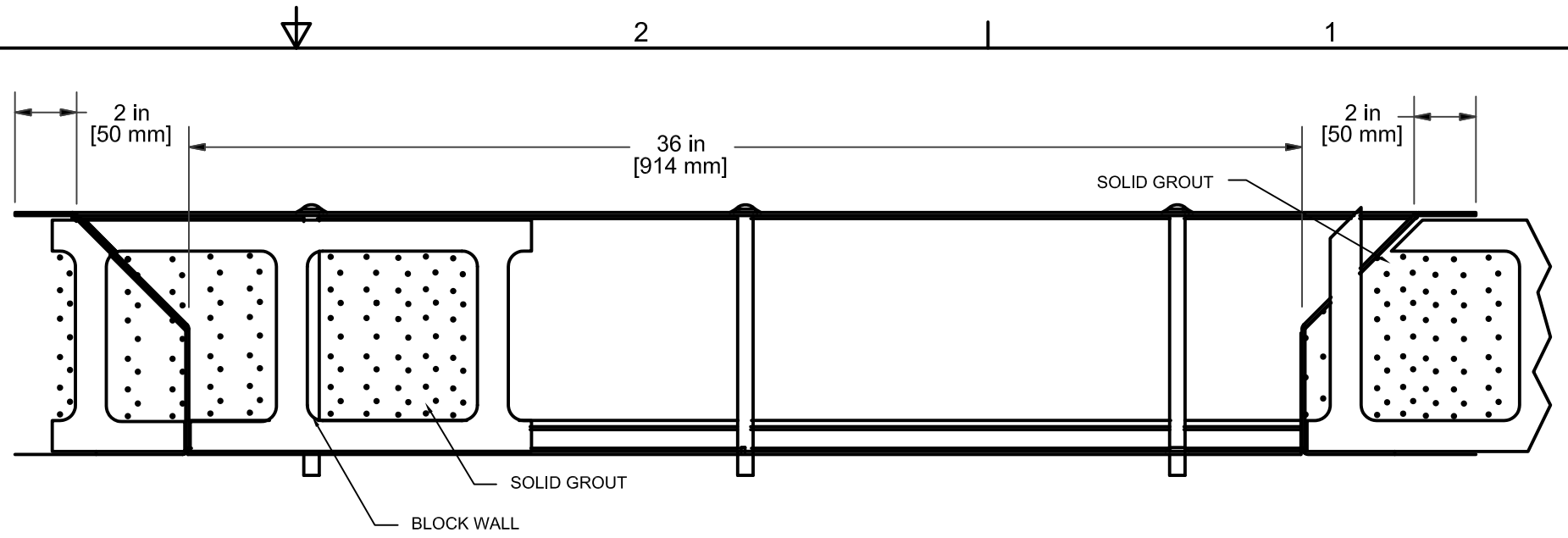
PG.#: 4

NOTE: FRAME MUST BE FULLY GROUTED FOR PROPER SLIDING ASSEMBLY INSTALLATION

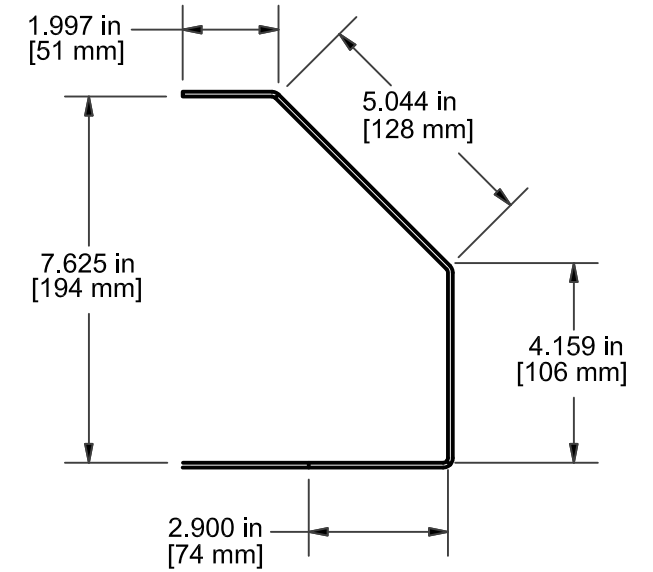
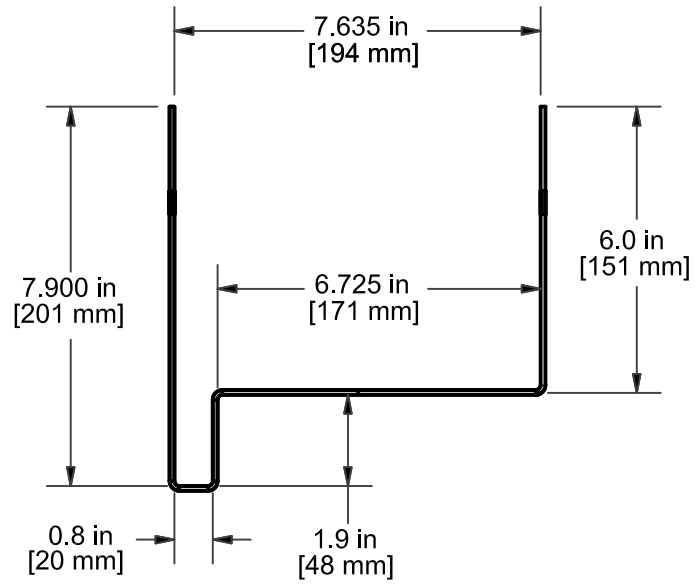
NOTE: OPTIONAL 2" LENGTH X 3/16" [51 x 5 mm] FILLER PLATE CONTINUALLY WELDED TO HEADER AND SIDES OF FRAME.



**A-5 SECTION THROUGH FRAME**



**B-5 CROSS SECTION THROUGH JAMBS & HEADER**



**C-5 JAMB PROFILES FOR BENDING**

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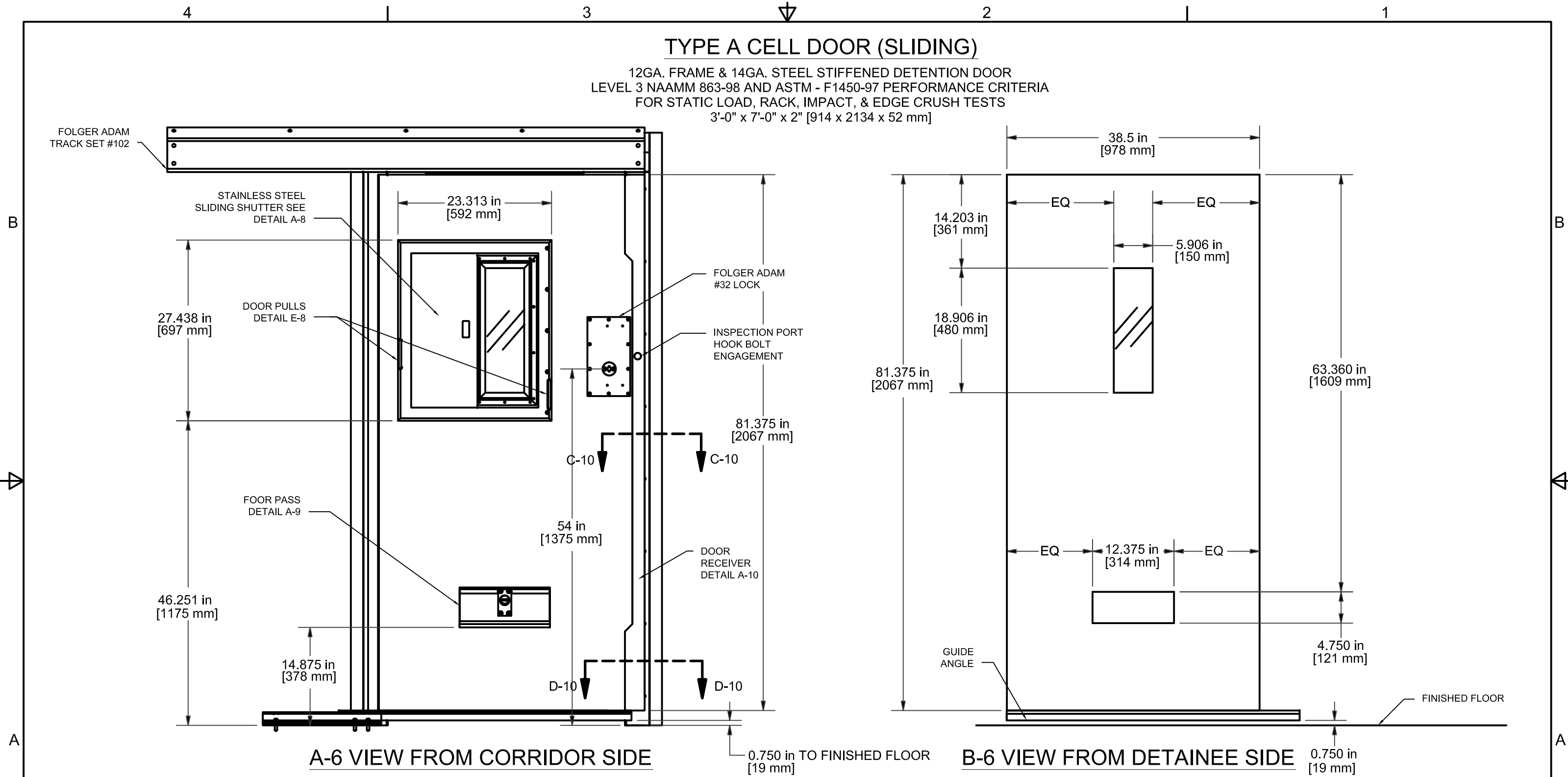
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FILE NUMBER:

PG.#: 5

# TYPE A CELL DOOR (SLIDING)

12GA. FRAME & 14GA. STEEL STIFFENED DETENTION DOOR  
 LEVEL 3 NAAMM 863-98 AND ASTM - F1450-97 PERFORMANCE CRITERIA  
 FOR STATIC LOAD, RACK, IMPACT, & EDGE CRUSH TESTS  
 3'-0" x 7'-0" x 2" [914 x 2134 x 52 mm]



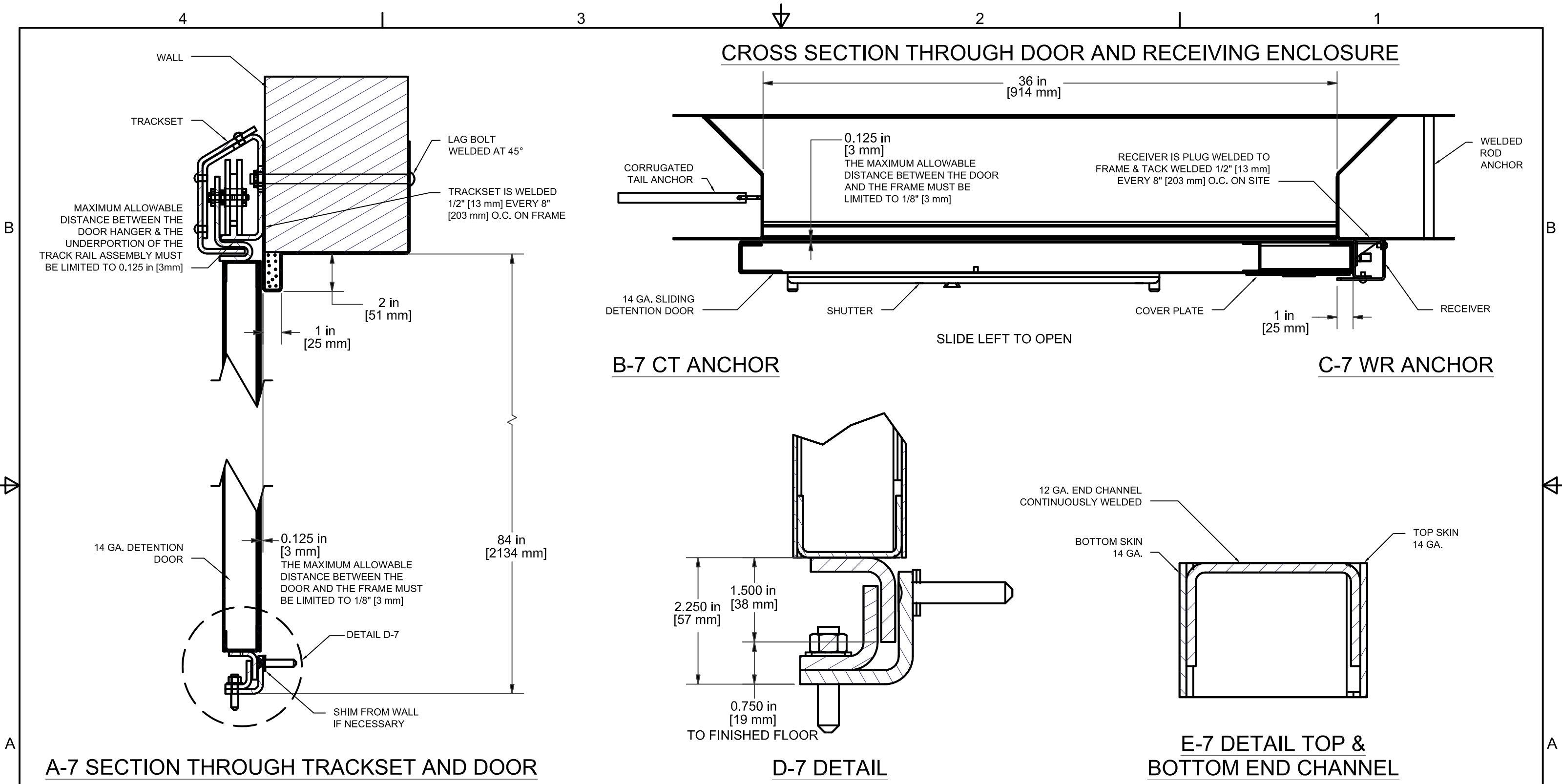
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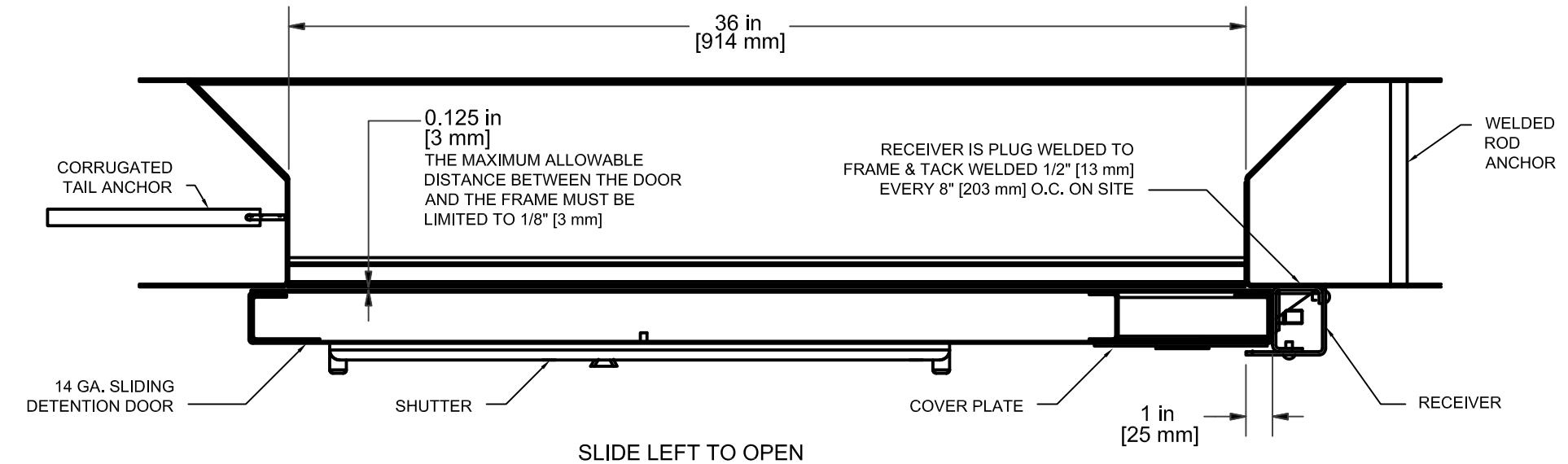
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CONTRACTOR:		
DRAWN BY: CL JOHNSON	DATE: 9/26/2007	
W.O.#:	FILE NUMBER:	PG.#: 6



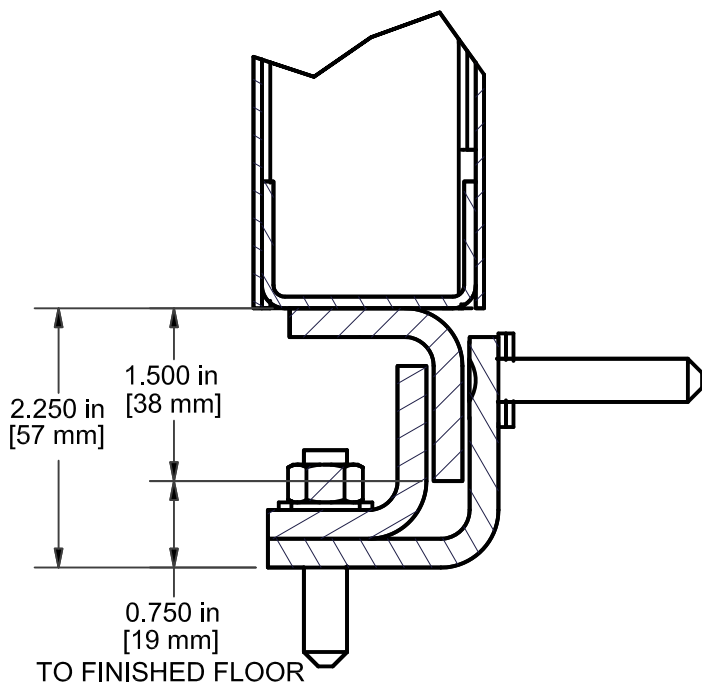
**A-7 SECTION THROUGH TRACKSET AND DOOR**

**CROSS SECTION THROUGH DOOR AND RECEIVING ENCLOSURE**

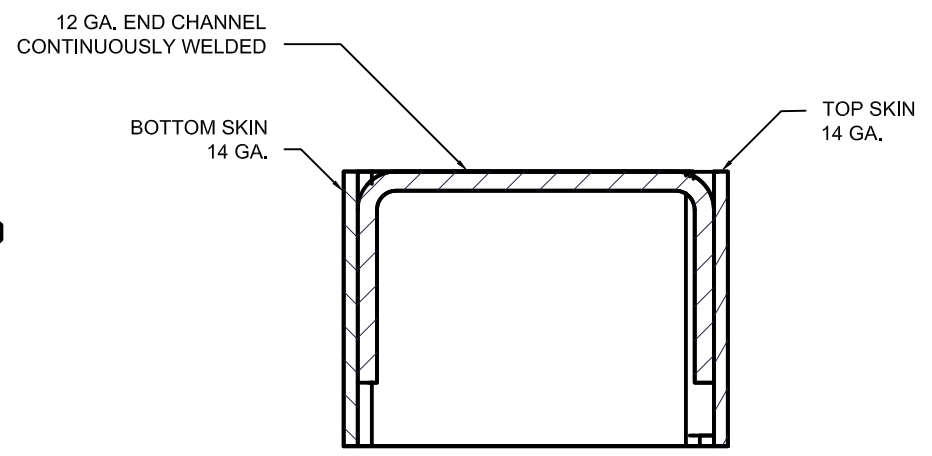


**B-7 CT ANCHOR**

**C-7 WR ANCHOR**



**D-7 DETAIL**



**E-7 DETAIL TOP & BOTTOM END CHANNEL**

**FINAL**

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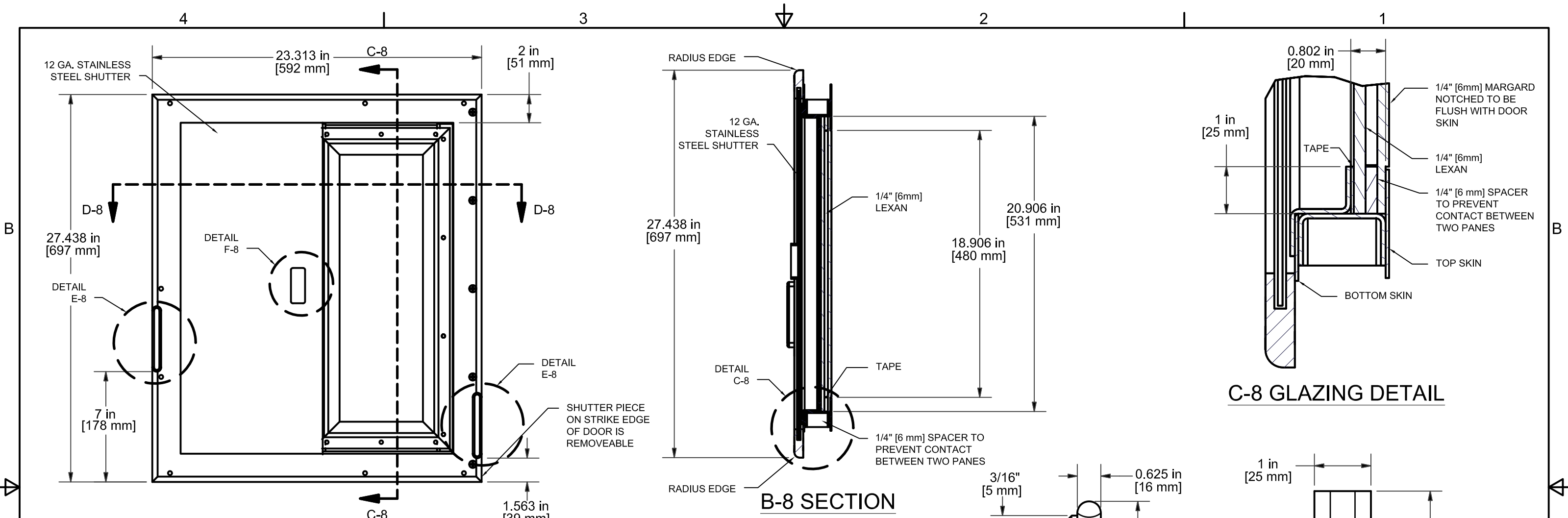
NOTES:  
SEE A-3 FOR ADDITIONAL ANCHOR OPTIONS

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JOB:

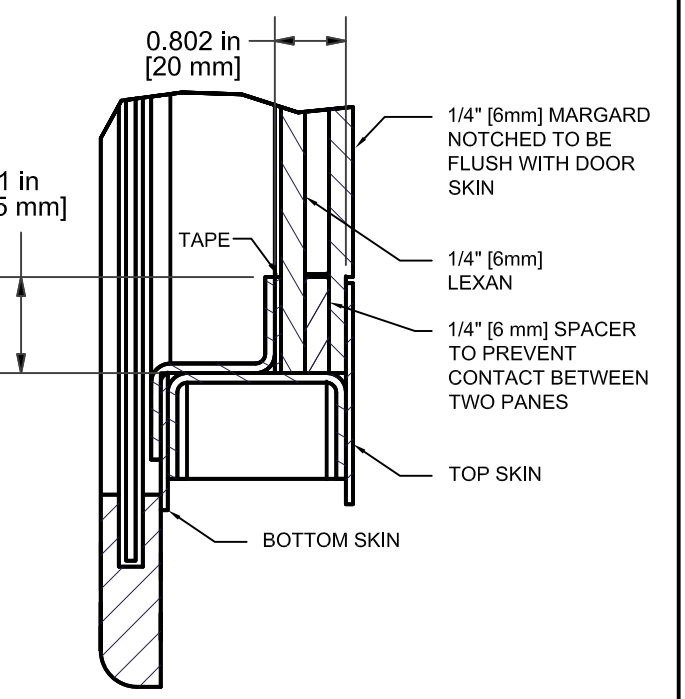
CONTRACTOR:

DRAWN BY: CL JOHNSON	DATE: 9/26/2007
W.O.#:	FILE NUMBER:
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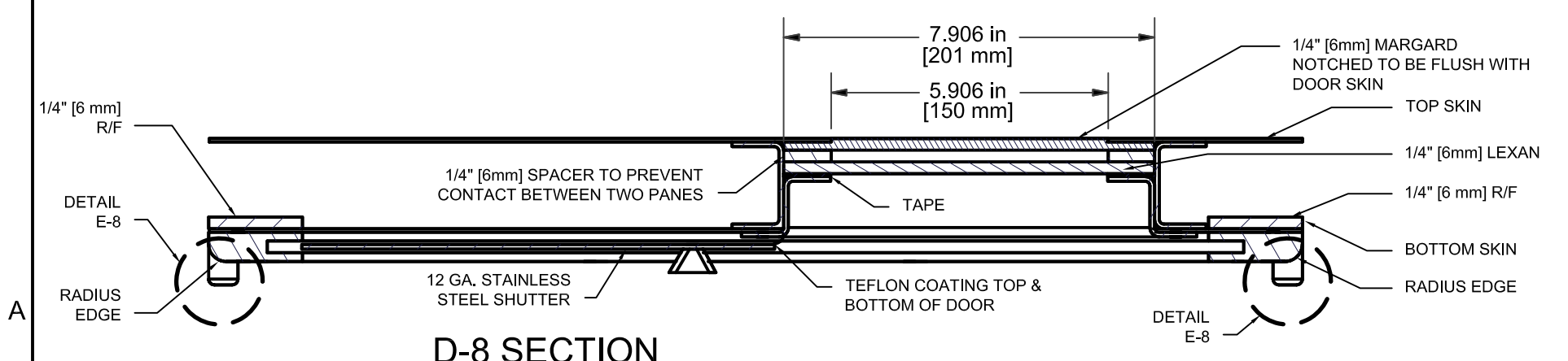


**A-8 SLIDING SHUTTER**

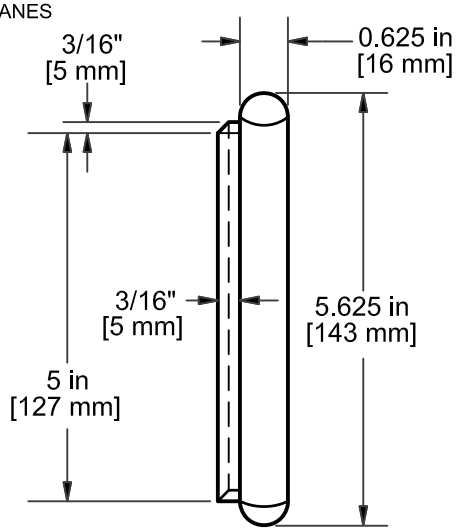
**B-8 SECTION**



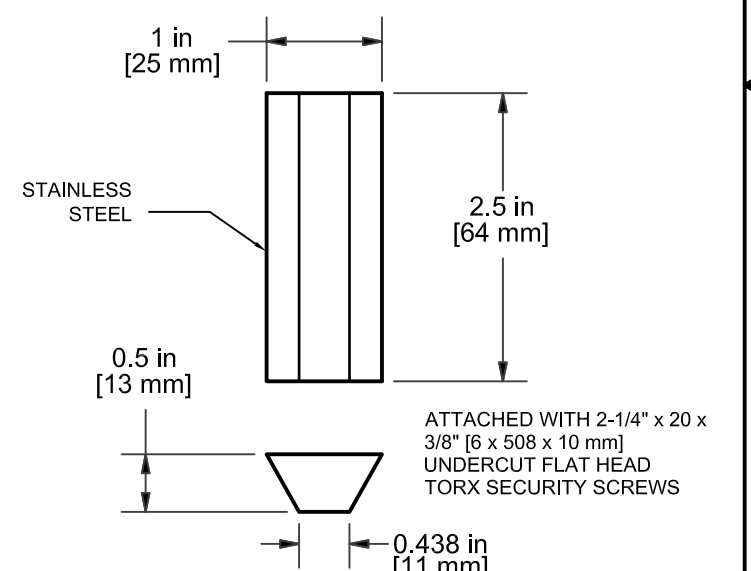
**C-8 GLAZING DETAIL**



**D-8 SECTION**



**E-8 SLIDING DOOR HANDLE DETAIL**



**F-8 SHUTTER HANDLE DETAIL**

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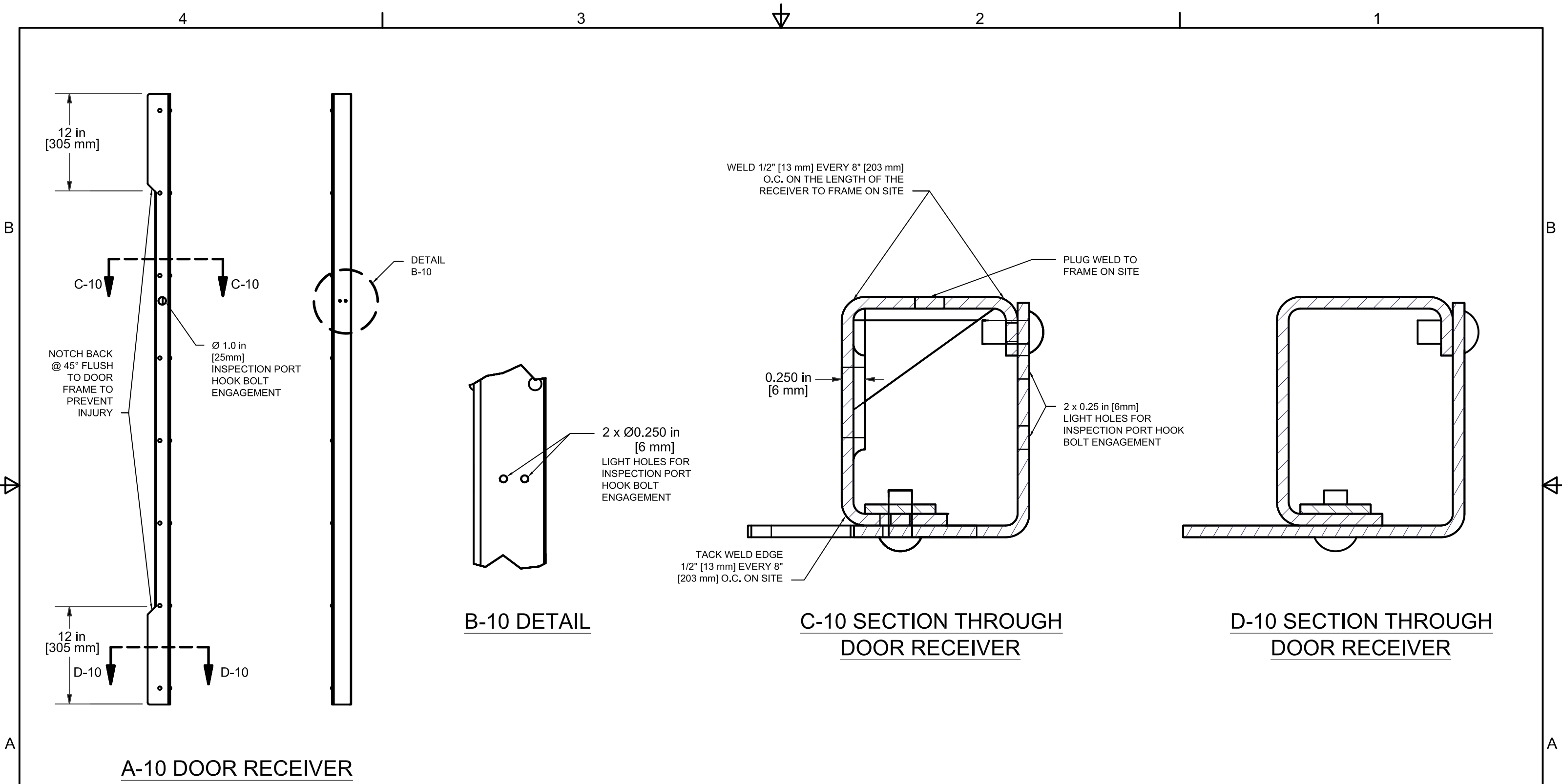
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8









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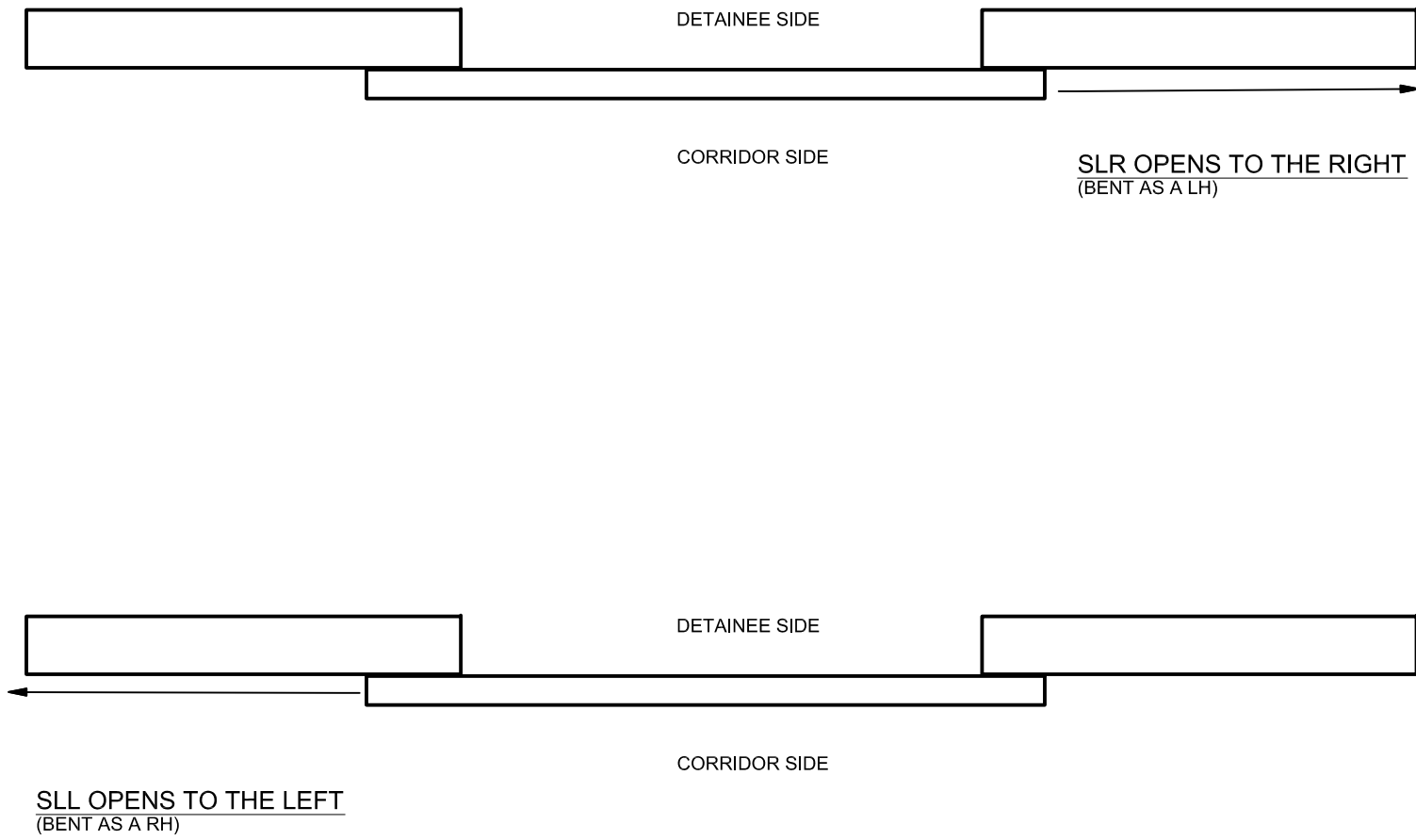
NOTES:  
 REMOVE ALL BURRS AND SHARP EDGES AFTER WELDING

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# A-11 SLIDING HANDING SHEET



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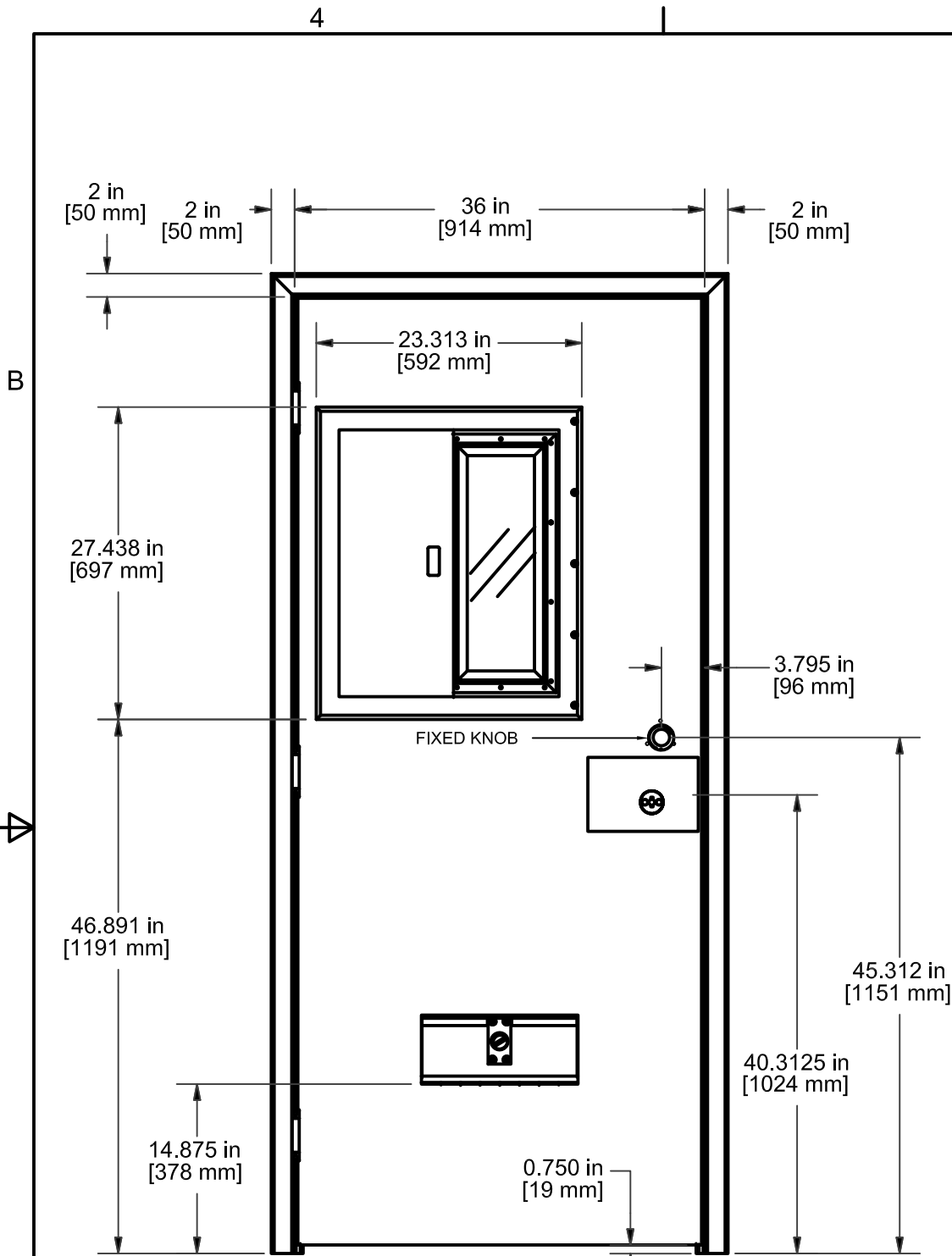
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PG.#: 11

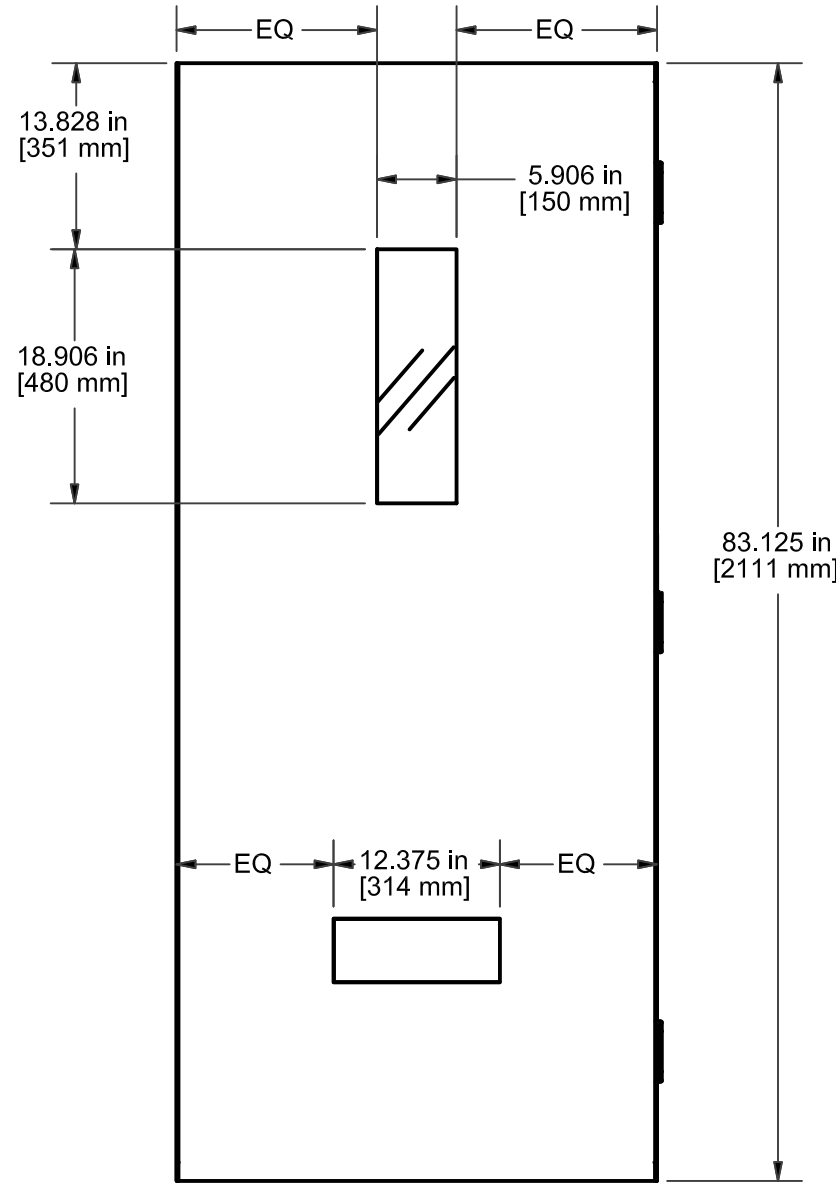
# TYPE B CELL DOOR (SWINGING)

(MAY ALSO BE INSTALLED IN TYPE A CELLS)  
 12GA. FRAME & 14GA. STEEL STIFFENED DETENTION DOOR  
 LEVEL 3 NAAMM 863-98 AND ASTM - F1450-97 PERFORMANCE CRITERIA  
 FOR STATIC LOAD, RACK, IMPACT, & EDGE CRUSH TESTS  
 3'-0" x 7'-0" x 2" [914 x 2134 x 51 mm]

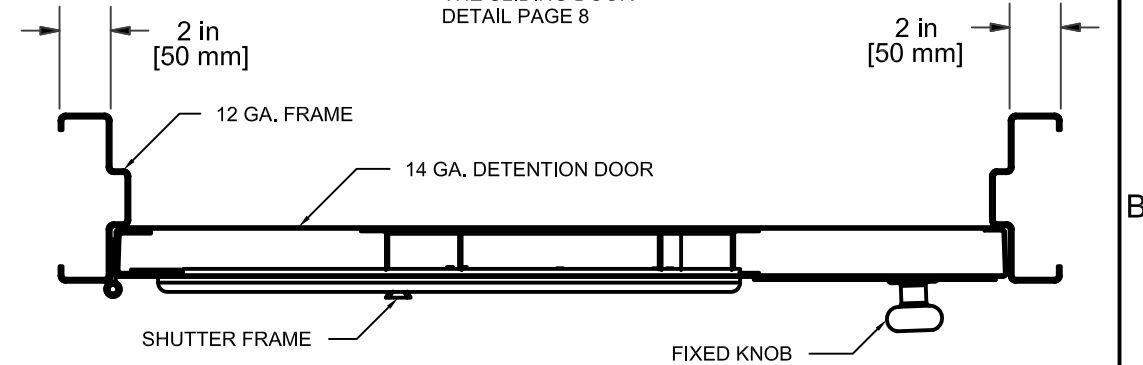
NOTE: LITE KIT IS THE SAME AS  
 THE SLIDING DOOR  
 DETAIL PAGE 8



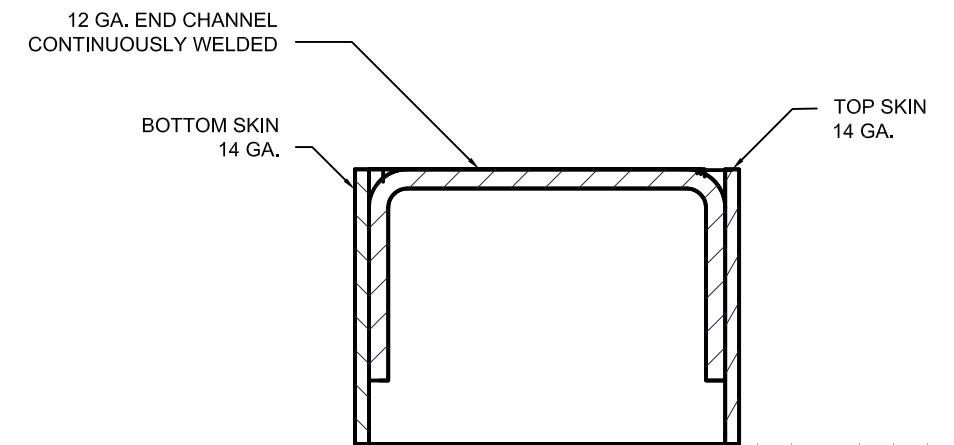
A-12 VIEW FROM CORRIDOR SIDE



B-12 VIEW FROM DETAINEE SIDE



C-12 CROSS SECTION THROUGH DOOR & FRAME



D-12 DETAIL TOP & BOTTOM END CHANNEL

REVISIONS:

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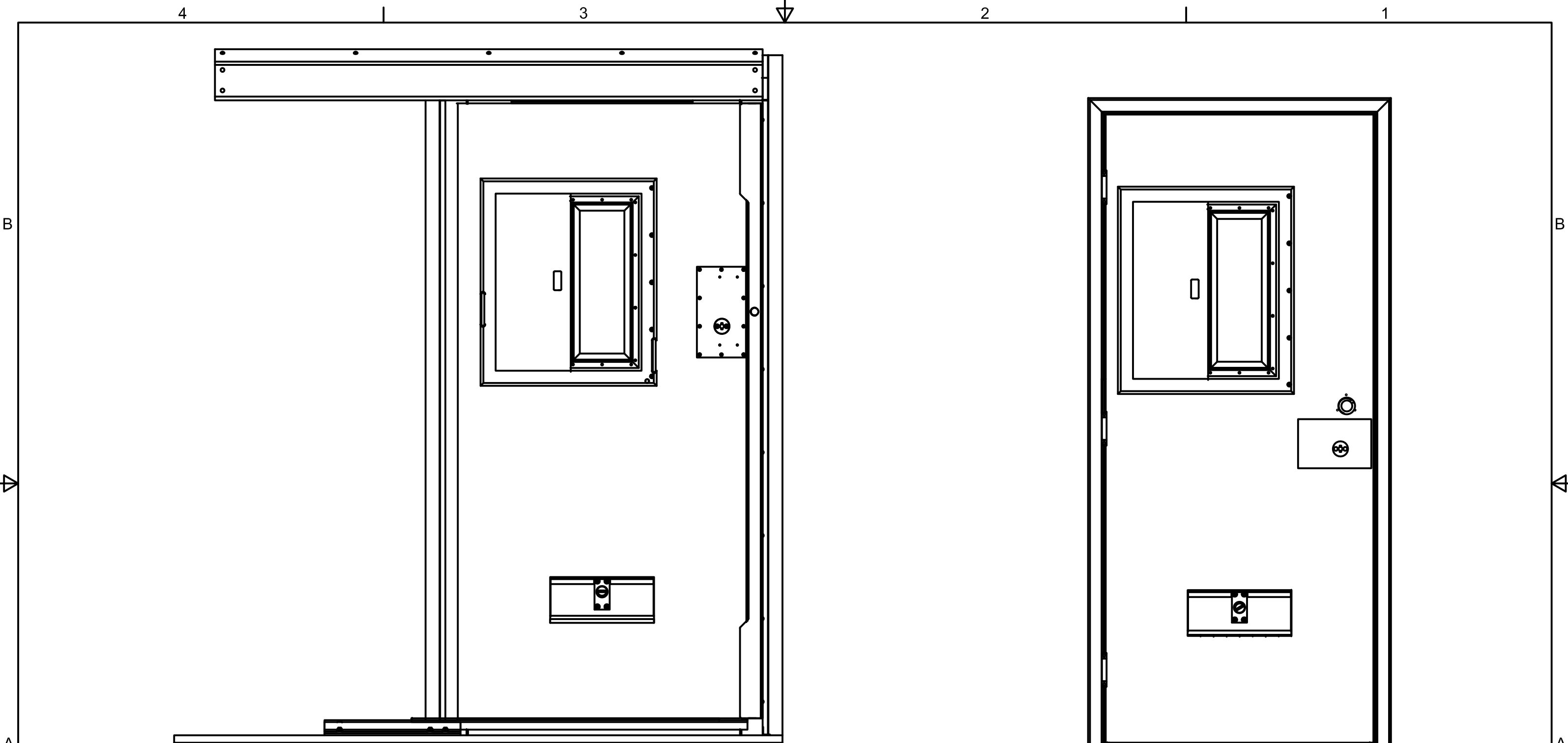
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9/26/2007

W.O.#:

FILE NUMBER:

PG.#:

12



A-13 RCMP SLIDING DOOR

B-13 RCMP SWINGING DOOR

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9/26/2007

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FILE NUMBER:

PG.#: 13

4

3

2

1

### TYPE A CELL DOOR (SLIDING)

SPOT WELDS @ 4"  
[102 mm] O.C. (TYP.)

SPOT WELDS @ 4"  
[102 mm] O.C. (TYP.)

### A-14 TOP SKIN PROFILE

12 GA. PERIMETER  
CHANNEL

12 GA. PERIMETER  
CHANNEL

SPOT WELDS @ 4"  
[102 mm] O.C. (TYP.)

SPOT WELDS @ 4"  
[102 mm] O.C. (TYP.)

NO BEVEL

### B-14 BOTTOM SKIN PROFILE

CONTINUOUS WELD  
ALONG SEAM

FILL ALL VOIDS WITH FIBERBOARD  
INSULATION (TYPICAL)

14 GA. SKINS

WELD

### C-14 TOP & BOTTOM SKIN ASSEMBLY PROFILE

REVISIONS:

NOTES:

JOB:

REVISION AS PER THE  
MEETING ON JULY 20, 2006

THIS DOOR IS A SQUARE EDGE AS IT IS SLIDING

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FILE NUMBER:

PG.#:

14

4

3

2

1

4

3

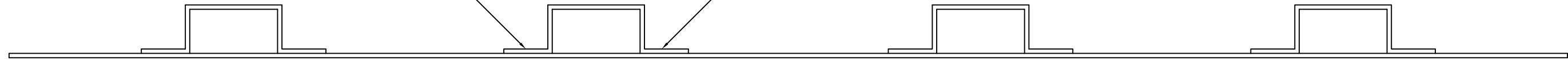
2

1

### TYPE B CELL DOOR (SWINGING)

SPOT WELDS @ 4"  
[102 mm] O.C. (TYP.)

SPOT WELDS @ 4"  
[102 mm] O.C. (TYP.)



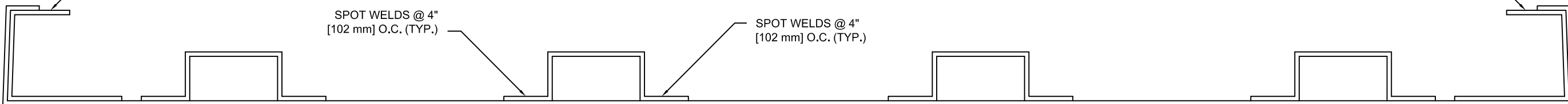
### A-15 TOP SKIN PROFILE

12 GA. PERIMETER CHANNEL

SPOT WELDS @ 4"  
[102 mm] O.C. (TYP.)

SPOT WELDS @ 4"  
[102 mm] O.C. (TYP.)

12 GA. PERIMETER CHANNEL



### B-15 BOTTOM SKIN PROFILE

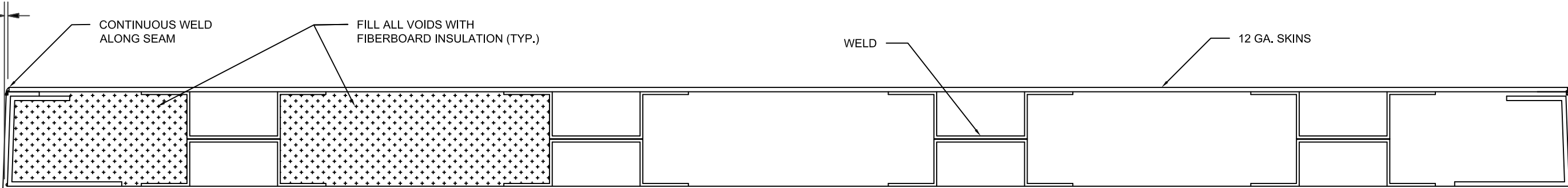
0.125 in  
[3 mm]  
BEVEL IN 2 in  
[50 mm] DOOR

CONTINUOUS WELD  
ALONG SEAM

FILL ALL VOIDS WITH  
FIBERBOARD INSULATION (TYP.)

WELD

12 GA. SKINS



### C-15 TOP & BOTTOM SKIN ASSEMBLY PROFILE

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FILE NUMBER:

PG.#:

15

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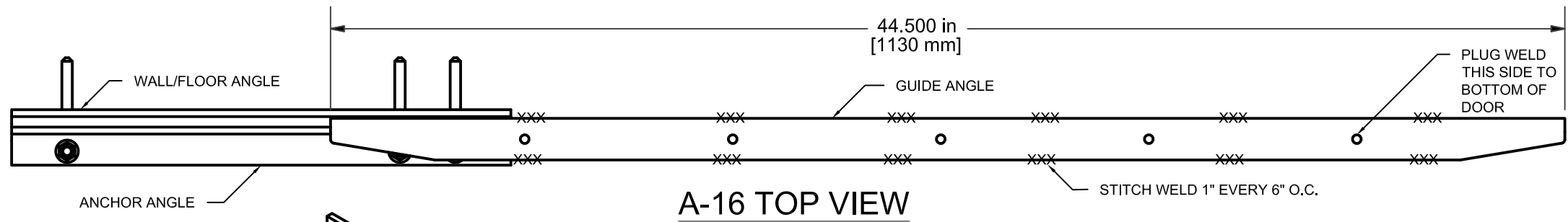
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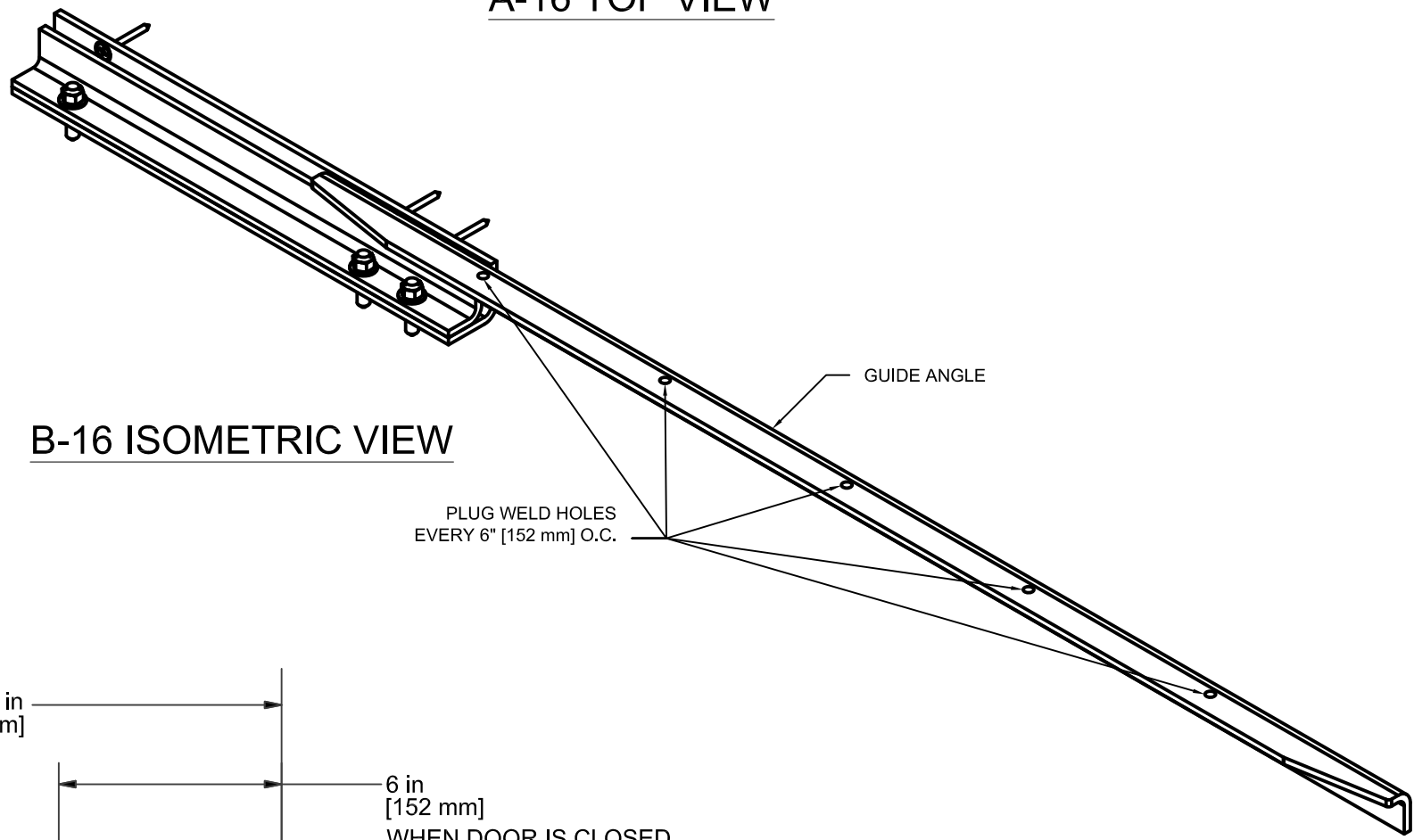
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1

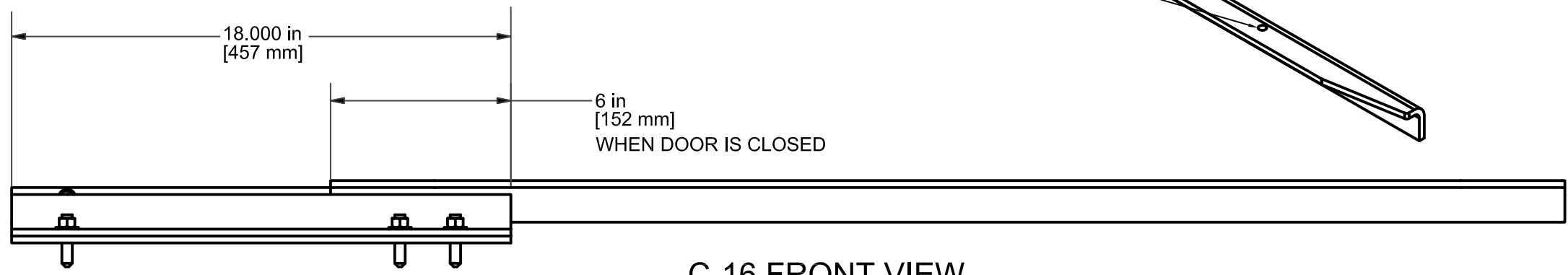
INSTALLATION OF WALL/FLOOR & ANCHOR ANGLE & GUIDE ANGLE



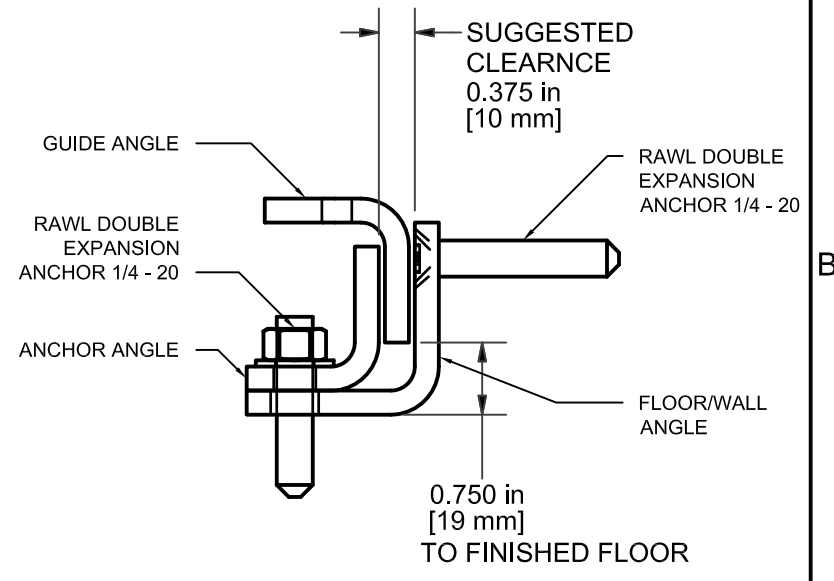
A-16 TOP VIEW



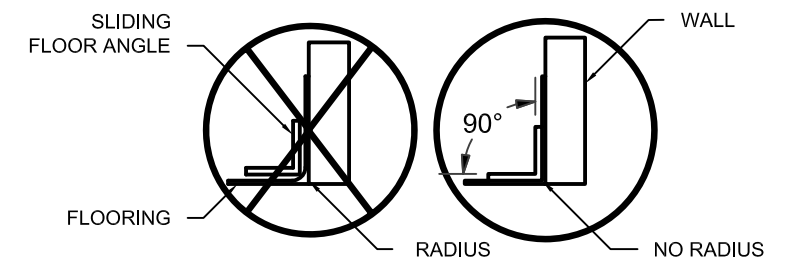
B-16 ISOMETRIC VIEW



C-16 FRONT VIEW



D-16 DETAIL



NOTE: FLOORING IS NOT TO HAVE A RADIUS WHERE IT MEETS THE WALL, FOR SLIDING UNITS.

E-16 FLOORING DETAIL

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16