

PART 1 GENERAL

1.1 ARCHITECT, CONSULTANT OR ENGINEER

- .1 Wherever the word Architect, Consultant or Engineer is used in the construction specifications, it shall be replaced with Contract Administrator as defined in C1.1(o) and C5 of General Conditions for Construction Contracts and D1 of Supplemental Conditions.

1.2 CODES AND STANDARDS

- .1 Execute Work in accordance with the latest editions and supplements of the applicable regulations and standards listed below and as stated in the specifications:
 - .1 Manitoba Building Code
 - .2 Manitoba Fire Code
 - .3 Federal, Provincial and Municipal government laws, rules, ordinances and codes, where applicable.
 - .4 Refer to General Conditions for Construction Contracts.
- .2 Where specified standards are not dated, conform to the latest issue of specified standard, amended and revised as of the date for receipt of bids.
- .3 Work shall meet or exceed requirements of specified standards, codes and referenced documents. Even if permitted by preceding regulations and standards, grade of Work shall in no case be lower than specified in project specifications.
- .4 Electrical components and equipment, which are not CSA approved, shall be approved by the Manitoba Department of Labour and Manpower prior to connection to the electrical service. Pay for all costs associated with obtaining the necessary approval.
- .5 Unless specified otherwise, the Contractor shall, at his own expense, obtain all required permits and certificated of inspection and approval from proper authorities.

1.3 BUILDING ENVELOPE

- .1 Comply with the National Building Code (NBC), 2005, Section 5 "Wind, Water and Vapour Protection". Building Envelope shall resist air leakage, vapour diffusion, rain penetration, moisture and groundwater infiltration, and flame spread.
- .2 Avoid penetrating through building envelope air barrier. Where penetrations are necessary, maintain integrity of air barrier by patching and making good to the approval of the Contract Administrator with approved material and methods.
- .3 Patch and make good building envelope at all locations where envelope has been penetrated as a result of removal and/or relocation of existing equipment, piping, ductwork, conduit, cable, wiring, etc. Use only approved materials and methods.

1.4 CONSTRUCTION SAFETY

- .1 Observe and enforce all construction safety measures required by the Manitoba Building Code, Worker's Compensation Board, Municipal Statute or By-Laws.
- .2 In the event of conflict between any provisions of above authorities, the most restrictive provision shall apply.
- .3 During winter construction, when combustion type space heaters are employed, provide adequate ventilation for safety of workers.
- .4 The Contractor shall be registered with the Workers Compensation Board of Manitoba and shall provide and maintain workers compensation coverage throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

1.5 LAYOUT OF THE WORK

- .1 Provide all devices required and assume full responsibility for and execute complete layout of the Work to main lines and levels in relation to designated reference points and benchmarks. Protect all markings, benchmarks, and monuments from movement or destruction.
- .2 Supply such devices as straight edges and templates required to facilitate Contract Administrator's review of Work.

1.6 DEFINITION OF TRADES

- .1 For convenience of reference only, the specifications are separated into the internationally recognized titled/trade sections. (See table of contents). Sections are identified by title and six-digit number system.
- .2 The Contractor shall decide who supplies and installs required materials or equipment and extras will not be considered on the grounds of differences in interpretation of the Project Documents as to who performs what Work.
- .3 The Contractor is totally responsible as to who provides required materials or articles and Work.
- .4 The Contractors are to allow for continued access throughout the construction period and ensuring the facility's entering and exiting is maintained to the approval of the Local Authorities having Jurisdiction, local by-laws, and Work Place Safety and Health Policies. This will also be applicable for parking lot accesses and other such requirements to assist the City in maintaining normal operations.
- .5 Generally, construction activities shall be restricted to the Work areas as defined. Where Work must proceed outside of designated Work areas, all scheduling shall be arranged with the Contract Administrator prior to commencement of such Work. The Contractor is to submit a Safety Access Plan as well as a Detailed Site Co-ordination Plan.
- .6 The Contractor shall, in his construction schedule, allow a period of time from completion of one sequence to commencement of Work on the next sequence to allow for testing and commissioning of equipment, thus allowing time for the City employees to vacate the next Work area.
- .7 The Contractor shall provide a Construction Schedule for each individual sequence of Work indicating commencement and completion dates for each sequence. The Contractor shall be aware that Substantial Performance under the Lien Act applies to the Total Contract and not to the completion and occupancy of the individual Sequence of the Work.
- .8 The Contractor shall submit as-built drawings and maintenance manuals for each sequence of Work at completion of each sequence.

1.7 USE OF SITE AND PREMISES

- .1 The Contractor's use of premises, Site access and construction activities are limited to those areas as defined on drawings.
- .2 Construction personnel must use only designated entrances for access to Work areas, delivery of materials and/or equipment and removal of construction debris.
- .3 Restrict equipment, Work and workers to designated areas and established routes to and from Work areas.
- .4 Storage of construction materials, tools, equipment, etc. in areas outside designated Work areas is not permitted.
- .5 If required, obtain and pay for use of off-site storage or Work areas needed for operations or for delivered equipment or materials not required immediately on the premises.

- .6 Keep all fire lanes, egress, and access routes clear at all times.
- .7 Parking restrictions may be applied and on Site parking will be allowed at the City's discretion.
- 1.8 OCCUPANCY OF WORK AREAS BY THE CITY
 - .1 The City reserves the right to enter and occupy Work areas in whole or in part before completion of the Contract, provided that, in the opinion of the Contract Administrator, such entry and occupancy does not prevent or interfere with the Contractor in completion of the Contract.
 - .2 Such entry and occupation by the City is not to be considered as acceptance of the Work and will not relieve the Contractor from responsibility to complete the Contract.
- 1.9 GLASS BREAKAGE
 - .1 Contractors shall be responsible for all glass that is broken, scratched or cracked during the execution of the Work and shall replace such glass at their own expense.
- 1.10 CLEANUP AND FINAL CLEANING OF THE WORK
 - .1 The Contractor shall maintain the Site and the Work in a tidy condition and free from the accumulation of waste products and debris. Upon attaining Substantial Performance of the Work, the Contractor shall remove any products, tools, construction machinery and equipment not required for the performance of the remaining Work. He shall also remove waste products and debris, and clean for suitable occupancy, unless otherwise specified.
 - .2 Total Performance of the Work shall not be attained until the Contractor has cleaned up the Site and has removed all plant and surplus products, tools, construction materials and equipment. The Contractor shall also have removed waste products and debris.
- 1.11 MOCK-UPS
 - .1 The Contractor shall erect mock-ups for inspection of materials and workmanship to allow the Contract Administrator to made adjustments to fixture or equipment location and/or arterial installation process, as may be necessary. There will be a requirement for a mock-up of window installation to ascertain tie in details of vapour and air barriers as well as rough opening treatment, flashing installations, etc.
 - .2 The mock-up shall not be limited to the window installations alone and all mock-ups shall be a part of the finished work as designated by the Contract Administrator and where specified throughout the contract documents. They shall be as complete as possible with all materials, finishes, fixtures and equipment indicated for installation.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Shop drawings and product data.
- .2 Samples

1.2 RELATED SECTIONS

- .1 Quality Control Section 01 45 00
- .2 Closeout Submittals Section 01 78 10

1.3 ADMINISTRATIVE

- .1 Submit to Contract Administrator 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 Contract Administrator. 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 Contract Administrator, 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 Contract Administrator's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .10 Keep one reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Refer to CCDC-2-1994.
- .2 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.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 7 days for Contract Administrator's review of each submission.

- .5 Adjustments made on shop drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .6 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of any revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subtrade.
 - .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.
- .9 After Contract Administrator's review, distribute copies.
- .10 Submit 6 prints of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.

- .11 Submit 6 hardcopy or electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator 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 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- 1.5 **SAMPLES**
- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
 - .2 Deliver samples prepaid to Contract Administrator's business address.
 - .3 Notify Contract Administrator 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 Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
 - .6 Make changes in samples which Contract Administrator 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.
- PART 2 PRODUCTS**
- 2.1 Not Used
 - .1 Not Used.
- PART 3 EXECUTION**
- 3.1 Not Used
 - .1 Not Used.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock ups.
- .4 Mill tests.
- .5 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

- .1 Submittal Procedures Section 01 33 00
- .2 Closeout Submittals Section 01 78 00

1.3 INSPECTION

- .1 Allow Contract Administrator 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 Contract Administrator 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 test is made, uncover such Work, have inspections or tests satisfactorily completed and make good such work.
- .4 Contract Administrator may order any part of Work to be examined if Work is suspected to be 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, Contract Administrator shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

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

1.5 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.

1.6 PROCEDURES

- .1 Notify appropriate agency and Contract Administrator 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.

1.7 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 Contract Administrator 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 the opinion of Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, the City may deduct from the Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Contract Administrator.

1.8 REPORTS

- .1 Submit 2 copies of inspection and test reports to Contract Administrator.
- .2 Provide copies to Sub-trade of Work being inspected or tested or manufacturer or fabricator of material being inspected or tested.

1.9 TESTS AND MIX DESIGNS

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

1.10 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Prepare mock-ups for Contract Administrator's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
- .3 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.
- .4 If requested, Contract Administrator will assist in preparing a schedule fixing dates for preparation.

- .5 Remove mock-up at conclusion of Work or when acceptable to Contract Administrator.
- .6 Mock-ups may remain as part of Work as approved by Contract Administrator.
- 1.11 MILL TESTS
 - .1 Submit mill test certificates as required of specification Sections.
- 1.12 EQUIPMENT AND SYSTEMS
 - .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- PART 2 PRODUCTS**
- 2.1 Not Used
 - .1 Not Used.
- PART 3 EXECUTION**
- 3.1 Not Used
 - .1 Not Used.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection and transportation.
- .2 Manufacturer's instructions.
- .3 Quality of Work, coordination and fastenings.
- .4 Existing facilities

1.2 RELATED SECTIONS

- .1 Quality Control Section 01 45 00

1.3 REFERENCE STANDARDS

- .1 Conform to these standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether any product or system is in conformance with applicable standards, Contract Administrator reserves the right to have such products or systems tested to prove or disprove conformance.
- .3 The cost for such testing will be borne by the City in event of conformance with Contract Documents or by Contractor in the event of non-conformance.
- .4 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.4 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 Contract Administrator based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacturer 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.

1.5 AVAILABILITY

- .1 Immediately upon Contract Award, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Contract Administrator at commencement of Work and should it be subsequently appear that Work may be delayed for such reason, Contract Administrator reserves the right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.6 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 Contract Administrator.
- .9 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Contractor to pay transportation costs on recycled products supplied by the City. Unload, handle and store such products.

1.8 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 Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that the Contract Administrator may establish a course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

1.9 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 Contract Administrator if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in his or her required duties. Contract Administrator 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 Contract Administrator, whose decision is final.

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- 1.10 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.
- 1.11 CONCEALMENT
- .1 In finished areas, conceal pipes, ducts, and wiring in floors, walls and ceilings, except where indicated otherwise.
 - .2 Before installation, inform Contract Administrator if there is interference. Install as directed by Contract Administrator.
- 1.12 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.
- 1.13 LOCATION OF FIXTURES
- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
 - .2 Inform Contract Administrator of conflicting installation. Install as directed.
- 1.14 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.
- 1.15 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 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.

1.16 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 Contract Administrator.

1.17 EXISTING UTILITIES

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

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used.

PART 3 EXECUTION

3.1 Not Used

- .1 Not used.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Field engineering survey services to measure and stake site.
- .2 Survey services to establish inverts for Work.
- .3 Recording of subsurface conditions found.

1.2 REFERENCES

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

1.3 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practise in Place of Work, acceptable to Contract Administrator.

1.4 SURVEY REFERENCE POINTS

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

1.5 SURVEY REQUIREMENTS

- .1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill placement.
- .4 Stake slopes.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation column locations, major grid radius points and floor elevations.
- .8 Establish lines and levels for mechanical and electrical Work.

1.6 EXISTING SERVICES

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

1.7 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
 - .3 Inform Contract Administrator of impending installation and obtain approval for actual location.
 - .4 Submit field drawings to indicate relative position of various services and equipment when required by Contract Administrator.
- 1.8 RECORDS
- .1 Maintain a complete, accurate log of control and survey Work as it progresses.
 - .2 Record locations of maintained, re-routed and abandoned service lines.
- 1.9 SUBMITTALS
- .1 Submit name and address of Surveyor to Contract Administrator.
 - .2 On request of Contract Administrator, submit documentation to verify accuracy of field engineering Work.
 - .3 Submit certificate signed by surveyor certifying those elevations and locations of completed Work that conform and do not conform with Contract Documents.
 - .4 Provide a surveyor's sealed and stamped drawing indicating building location certificate at project completion.
- 1.10 SUBSURFACE CONDITIONS
- .1 Promptly notify Contract Administrator in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
 - .2 After prompt investigation, should Contract Administrator determine that conditions do differ materially, instructions will be issued for Changes in Work by Change Order, and Change Directive.
- PART 2 PRODUCTS**
- 2.1 Not Used
- .1 Not used.
- PART 3 EXECUTION**
- 3.1 Not Used
- .1 Not used.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 As-built drawings, samples, and specifications
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.
- .7 Final site survey certificate.

1.2 RELATED SECTIONS

- .1 Submittal Procedures Section 01 33 00
- .2 Quality Control Section 01 45 00
- .3 Preparation Section 01 70 00

1.3 SUBMISSION

- .1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Contract Administrator's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, four (4) final copies of operating and maintenance manuals in English.
- .5 At Total Performance, the Contractor shall provide the Contract Administrator with one (1) set of record drawings as "As-Built" Drawings and specifications bearing notations of all changes and variations from the originals. The Contractor shall affix his company name and sign and date each drawing. The accuracy of these drawings shall be the responsibility of the Contractor, who shall bear all expenses of corrections thereto. Final payment shall not be made until this requirement has been fulfilled.
- .6 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.
- .7 If requested, furnish evidence as to type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.4 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf with spine.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
 - .5 Arrange content by systems 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.
- 1.5 CONTENTS – EACH VOLUME
- .1 Table of Contents: provide title of project;
 - .1 Date of submission; names,
 - .2 Addresses, and telephone numbers of Contract Administrator and with name of responsible parties;
 - .3 Schedule of products and systems, indexed to content of volume.
 - .2 For each product or system:
 - .1 List full names, addresses and telephone numbers of applicable sub-trades 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 date 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 01 45 00 – Quality Control.
- 1.6 AS-BUILTS AND SAMPLES
- .1 In addition to requirements in General Conditions, maintain at the site for Contract Administrator one record copy of:
 - .1 Contract Drawings (As built).
 - .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 Contract Administrator.
- 1.7 RECORDING ACTUAL SITE CONDITIONS
- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Contract Administrator.
 - .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 depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 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.
- 1.8 FINAL SURVEY
- .1 Contractor is to provide Building Location Certificate at project completion.
- 1.9 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 01 45 00 – Quality Control.
 - .15 Additional requirements: As specified in individual specification sections.
- 1.10 MATERIALS AND FINISHES
- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. 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 Addition Requirements: as specified in individual specifications sections.
- 1.11 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 site; place and store.
 - .4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- 1.12 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 site; place and store in locations as directed by Contract Administrator.
- .4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.
- 1.13 SPECIAL TOOLS
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.
- 1.14 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 Contract Administrator.
- 1.15 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 City's permission, leave date of beginning of time of warranty until the Date of Total 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**
- 2.2 Not Used
 - .1 Not used.
- PART 3 EXECUTION**
- 3.2 Not Used
 - .1 Not used.

PART 1 GENERAL

- .1 This section specifies requirements for demolishing, salvaging and removing wholly or in part, various items designated to be removed or partially removed and for backfilling resulting trenched, holes, and pits.

1.1 RELATED SECTIONS

- .1 Excavating, Trenching and Backfilling Section 31 23 16

1.2 PROTECTION

- .1 Protect existing objects designated to remain and materials designated for salvage. In event of damage immediately replace or make repairs subject to the Contract Administrator's approval of and at no additional cost to the project.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Inspect site and verify with Contract Administrator objects designated for removal and objects to be preserved.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.

3.2 REMOVAL

- .1 Remove objects, including trees indicated on the drawing.
- .2 Do not disturb adjacent items designated to remain in place.
- .3 In removal of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other approved method.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying granular materials.
 - .4 When removing pipes under existing or future pavement area, excavate at least 300 mm below pipe level.
 - .5 Provide for suppression of dust generated by removal process.

3.3 DISPOSAL OF MATERIAL

- .1 Dispose of materials not designated for salvage or re-use in Work, off site.

3.4 BACKFILL

- .1 In paved area, backfill with granular material and shape excavation to elevations shown on the drawings in accordance with Section 31 23 16.
- .2 In areas not to be paved, backfill and shape excavation to elevation shown on drawings with common backfill approved by Contract Administrator and in accordance with Section 31 23 16.

3.5 RESTORATION

- .1 Upon completion of Work, remove debris, trim surfaces and leave Work site clean.
- .2 Reinstate areas and existing Works outside areas of demolition to conditions that existed prior to commencement of Work.

PART 1 GENERAL

1.1 RELATED SECTIONS

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

1.2 WORK INCLUDED

- .1 Provide all labour, materials, equipment and services necessary to supply, erect, and strip all formwork and falsework for poured-in-place concrete shown or indicated on the contract drawings and specifications.

1.3 QUALITY ASSURANCE

- .1 Do concrete formwork and falsework to:
 - .1 Provincial Building Code - current edition.
 - .2 CSA Standard CSA-A23.1-04(CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION).
 - .3 CSA Standard CSA-A23.2-04 (METHODS OF TEST AND STANDARD PRACTICES FOR CONCRETE).
 - .4 CSA Standards S269.1 – 1975 (R2003) (FALSEWORK FOR CONSTRUCTION PURPOSES).
 - .5 ACI SP4 Chapter 5 (FORMWORK FOR CONCRETE).
 - .6 ACI Standard 347 (RECOMMENDED PRACTICE FOR CONCRETE FORMWORK).

1.4 TOLERANCES

- .1 The tolerances for all concrete work shall conform to the requirements of CSA Standard CSA-A23.1-04.

1.5 PRODUCT HANDLING

- .1 Protect formwork materials before, during and after installation and protect installed work and materials of other trades.
- .2 In the event of damage, immediately make required repairs or replacements necessary to the approval of the Consultant at no extra cost to the City.

PART 2 PRODUCTS

2.1 FORMWORK MATERIALS

- .1 Form Material
 - .1 Exposed surfaces - metal, plywood or plywood lined. Plywood to CSA Standard O121-M1978 (R2003) or CSA Standard O153-M1980 (R2003).
 - .2 Unexposed surfaces - metal, plywood to CSA Standard O121-M1978 or CSA Standard O153-M1980 (R2001), or wood lumber to CSA Standard CAN/CSA O86-01 (ENGINEERING DESIGN IN WOOD - LIMIT STATES DESIGN).
 - .3 Plywood and wood formwork materials shall conform to CSA Standard S269.1, be free from warp and sawn straight so that lines and shapes will be accurately retained.

- .4 Unlined forms for unexposed surfaces shall be made with a good grade of lumber or plywood and fitted so that there will be no leakage of mortar.
- .5 Use metal forms, plywood lined forms or plywood forms of sufficient structural strength for exposed surfaces. Plywood for lining shall be GIS exterior grade fir plywood with a waterproof glue.
- .2 Ties and Spreaders
 - .1 Use metal form ties which are adjustable in length to permit tightening of forms. Use only the snap-off type of form which will permit no metal within [1"] [25mm] of the concrete surface after removal. Twisted wire form ties will not be accepted.
- .3 Form Release Agent
 - .1 Form release agent shall be a pre-approved chemical agent, not an oil.
- .4 Void Form
 - .1 Void form shall be of a deteriorating material that will result in a total void thickness as noted on the drawings. If a non-biodegradable material is used the thickness must be adjusted to insure the required void volume is achieved. Contractor to submit technical data on void material for approval by the Contract Administrator.

PART 3 EXECUTION

3.1 FORMWORK

- .1 Lines and Levels
 - .1 Verify lines, levels and column centres before proceeding with work and ensure that dimensions agree with drawings.
 - .2 Coordinate and cooperate with all other trades in forming and setting of recesses, chases, sleeves, inserts, bolts and hangers.
- .2 Design
 - .1 Build forms sufficiently strong and rigid to sustain the weight or fluid pressure of the concrete without noticeable deflection. Ensure forms are sufficiently tight to prevent leakage or mortar.
 - .2 The Contractor shall be responsible for design and construction of falsework. The method and scheduling of reshoring shall be submitted to the Structural Consultant for review prior to fabrication.
- .3 Construction
 - .1 Construct forms so that the finished concrete will conform to the shape and dimensions specified.
 - .2 Construct forms so that they may be dismantled and removed without damaging the concrete.
 - .3 Set shores on wedges or use adjustable shores so they may be removed without causing undue strains in the concrete.
 - .4 Provide temporary openings at the bottom of column and wall forms to facilitate cleaning and inspection. Use water to flush out debris and close the openings with patch, flush on the inside.

.4 Treatment of Forms

- .1 Use a non-staining form release agent free from volatile constituents for treating forms.
- .2 Place form release agent prior to placing metal reinforcement.
- .3 Untreated forms shall be kept wetted down to prevent shrinkage prior to placing concrete and shall be surface wetted at time of placing.

.5 Alignment

- .1 Provide suitable means for checking the alignment and elevation of forms during placing. Check these items frequently during placing.
- .2 Carry out corrective wedging as required until concrete is in place.
- .3 The Contract Administrator shall have the right to order concrete removed which has become misaligned during placing.
- .4 Align forms to ensure that movements and deflections of the finished product are confined within the following specifications and tolerances.

- .1 The tolerances for all concrete work shall conform to the requirements of CSA Standard CSA-A23.1-04.
- .2 Variation in sizes and locations of sleeves, floor openings and wall openings -- 10mm.
- .3 Variation for steps in a flight of stairs - rise 4mm, tread 8mm in consecutive steps - rise 2mm, tread 4mm.

- .5 Formwork for slabs and beams shall be cambered as shown on the drawings. For calculation of such cambers, allowance for settlement, closure of form joints, elastic shortening of forms and shoring, must be made and added to camber requirements.

.6 Stripping

- .1 Formwork shall not be removed until the concrete has gained sufficient strength to carry dead loads and all possible construction loads liable to be imposed upon it. Notify the Contract Administrator before removing any formwork.
- .2 Remove forms in a manner to prevent spalling and other damage to the concrete surface. Forms shall be removed without hammering or prying against the concrete. Completely remove the forms from under steps and similar spaces, through temporary openings if necessary.
- .3 Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.

.7 Re-use of Formwork

- .1 Forms may be re-used after adequate cleaning, providing the faces have not cracked or become roughened. Such formwork shall be trimmed and properly patched.

3.2 INSERTS

- .1 All sleeves, openings, etc., shown on structural drawings must be checked with the Architectural, Mechanical and Electrical drawings. Sleeves, openings, etc., not shown on the structural drawings must be approved by the Contract Administrator.
- .2 Set ties, anchor bolts, pipe hangers and other inserts, openings and sleeves, in concrete floors and walls, as required by other trades.
- .3 No sleeves, ducts, pipes or other openings shall pass through beams or columns, except where detailed on the structural drawings.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Concrete Forming and Accessories Section 03 10 00
- .2 Concrete Reinforcing Section 03 20 00
- .3 Cast in Place Concrete Section 03 30 00

1.2 REFERENCE STANDARDS

- .1 Testing of concrete shall conform to the requirements of the following standards unless otherwise required by this specification
 - .1 Current Edition of Provincial Building Code
 - .2 CSA-A23.1-04 Concrete Materials and Methods of Concrete Construction
 - .3 CSA-A23.2-04 Methods of Test for Concrete
- .2 Where the standard is referred to in this specification it shall mean the documents specified in this clause.

PART 2 PRODUCTS

2.1 APPOINTMENT OF TESTING AGENCY

- .1 The City shall hire a CSA approved testing agency who shall test all concrete and grout as per this specification.
 - .1 Testing paid for by the Contractor:
 - .1 Review of Contractor requested mix design changes.
 - .2 Any waiting time incurred by the testing agency in excess of ½ hour.
 - .3 Any additional costs due to overtime, shift work, holiday or weekend work, except that holiday or weekend pickup will be paid for by The City when the concrete was placed on a regular workday.
 - .4 Costs for testing required by the Contractor for stripping.
 - .5 Cost for retesting or additional testing of concrete whose tests have failed to meet the specified requirements.

PART 3 EXECUTION

3.1 RESPONSIBILITY OF THE CONTRACTOR

- .1 The Contractor shall co-operate fully with the testing agency.
- .2 The Contractor shall give the testing agency at least 4 hours prior notice of a concrete placement.
- .3 It is the Contractor's responsibility to provide a finished product that meets the specification. If initial tests indicate that the concrete failed to meet the specification, the Contract Administrator shall decide if any additional testing is necessary. This testing shall be done by a CSA approved testing agency, but need not be The City's agency. The proposed additional testing shall have prior approval of the Contract Administrator. Core strengths must equal specified strength if tested dry or 85% specified if tested wet, with wet or dry tests as per the standard.

3.2 RESPONSIBILITY OF THE TESTING AGENCY

- .1 The testing agency has the authority to, and is expected to reject any concrete not meeting the specifications.
- .2 If the testing agency becomes aware that concrete is being placed without their being notified, or if insufficient notice is received, then the testing agency shall notify the Contract Administrator immediately.
- .3 Low 7 day and 28 day strength tests shall be brought immediately to the attention of the Contract Administrator and the Contractor.
- .4 All tests shall be numbered consecutively and the cylinders marked as follows: 7 day = A, two 28 days marked B and C.
- .5 All field cured cylinders shall be marked "F".

3.3 REGULAR TESTING

- .1 Shall conform to the standard, except each test shall consist of 3 cylinders. One for 7 day strength and two for 28 day strengths. The tests shall record concrete temperature, air temperature, slump, air content, location of pour, mix number, specified strength, and element type.

3.4 FIELD CURED CYLINDERS

- .1 Shall conform to the standard, except the cylinder shall be stored adjacent to the element it represents. The cylinder is to be left undisturbed at this location until picked up by the testing agency.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Concrete Formwork Section 03 10 00
- .2 Cast-in-Place Concrete Section 03 30 00

1.2 QUALITY ASSURANCE

- .1 Reinforcement work shall conform to the following standards
 - .1 Provincial Building Code - current edition
 - .2 CSA Standard CSA-A23.1-04. (CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION).
 - .3 CSA Standard CSA-A23.2-04 (METHODS OF TEST FOR CONCRETE).
 - .4 CSA Standard A23.3-04 (DESIGN OF CONCRETE STRUCTURES FOR BUILDINGS).
 - .5 ASTM A775-86 (STANDARD SPECIFICATION FOR EPOXY COATED REINFORCING CONCRETE CONSTRUCTION).
 - .6 CSA Standard W186-M1990 (R2 002) (WELDING OF REINFORCING BARS IN REINFORCED CONCRETE CONSTRUCTION).
 - .7 Reinforcing Steel Institute of Ontario (RSIO) Manual and Standard Practice.

1.3 QUALIFICATION OF WORKERS

- .1 Welding of concrete reinforcement shall be performed by workers who are approved by the Canadian Welding Bureau in accordance with CSA Standard W47.1-03 (CERTIFICATION OF COMPANIES FOR FUSION WELDING OF STEEL STRUCTURES).

1.4 SUBMITTALS

- .1 Mill Tests
 - .1 Upon request, provide the Contract Administrator with a certified copy of mill tests of steel supplied, showing physical and chemical analysis.
 - .2 The City may engage a CSA certified laboratory to test all reinforcing as detailed in this specification.
- .2 Shop Drawings:
 - .1 Prepare shop drawings for concrete reinforcement, bar support and accessories in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada, ANSI/ACI 315-80 and ACI 315R-80, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
 - .2 Upon request submit shop drawings in accordance with the General Requirements.
 - .3 Clearly indicate bar sizes, grades, spacing, location and quantities of reinforcing mesh, bar supports and accessories and identifying code marks to permit correct placement without reference to structural drawings.

- .4 Placing drawings and bar lists will be reviewed for number and size of bars only and this review shall in no way relieve the Contractor of his responsibility for carrying out the Work in accordance with the drawings.
- .5 Substitution of imperial reinforcing sizes and grades will only be accepted if placing drawings showing imperial sizes are submitted to the Contract Administrator for review. Approval must be obtained before any work is commenced.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Store reinforcement in a manner to prevent excessive rusting and fouling with dirt, grease, form-oil and other bond-breaking coatings.
- .2 Reinforcement at the time concrete is placed shall be free from excessive rusting, mud, oil or other coatings that adversely affect its bonding capacity.

PART 2 PRODUCTS

2.1 CONCRETE REINFORCEMENT

- .1 All concrete reinforcement shall conform to the following standards:
 - .1 Deformed bars to CSA Standard G30.18-M92 (R2002) (BILLET-STEEL BARS FOR CONCRETE REINFORCEMENT).
 - .2 Reinforcement that will be welded to CSA Standard CSA W186-M 1990 (R2002).
 - .3 Welded wire mesh to CSA Standard G30.18.
 - .4 Wire for reinforcement to CSA Standard G30.18.
- .2 Bar supports shall conform to ACI 316 (MANUAL OF STANDARD PRACTICE FOR DETAILED REINFORCED CONCRETE STRUCTURES) unless approved by the Contract Administrator.

2.2 FABRICATION

- .1 Fabricate reinforcing to CSA Standard CSA-A23.1-04 and reviewed shop drawings.
- .2 Fabricate reinforcing steel within the following tolerances:
 - .1 Sheared length plus or minus 25mm.
 - .2 Depth of truss bar plus or minus 10mm.
 - .3 Outside dimension of stirrups, ties and spirals, plus or minus 10mm.
 - .4 Other bends plus or minus 25mm.
- .3 Colour code each bar to correspond with code mark appearing on bar list.
- .4 Ship bundles of bar reinforcement clearly identified in accordance with bar lists.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Reinforcement shall be accurately placed and supported by bar supports and side form spacers to assure proper concrete cover and spacing within allowable tolerances before and during placing of concrete.
- .2 Bar supports shall be sufficient in number and strength to carry the reinforcement they support and prevent displacement by workers or equipment before and during concreting.

They shall be spaced so that any sagging between supports will not intrude on the specified concrete cover, or as required by the Contract Administrator.

- .3 Use concrete blocks for bar support in slab-on-grade. Lifting of reinforcing or welded wire mesh into specified position during the concrete pour will not be allowed.
- .4 Bars shall be placed on the following tolerances unless noted otherwise:
 - .1 Clear concrete protection of reinforcement, 5mm plus or minus.
 - .2 Where the depth of a flexural member, thickness of a wall or smallest dimension of a column is:
 - .1 200mm or less, 5mm plus or minus.
 - .2 Larger than 200mm, but less than 600mm, 10mm plus or minus.
 - .3 600mm or larger, 20mm plus or minus.
 - .4 Lateral spacing of these bars shall be within 30mm plus or minus of the specified spacing.
 - .3 For longitudinal location of bends and ends of bars 50mm plus or minus.
 - .4 As Item 3 at discontinuous ends of members 20mm plus or minus.
 - .5 Specified spacing between bars 10mm.
- .5 Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the specified tolerances, the resulting arrangement of bars shall be subject to approval of the Contract Administrator.
- .6 Bar support devices contacting surfaces exposed to the exterior, or to view, shall be non-corroding.

3.2 MINIMUM REINFORCEMENT WHERE NOT SHOWN OR INDICATED

- .1 Concrete walls, 10M at 300mm each way, centered.
- .2 Slab-on-grade, 10M at 400mm each way, centered.
- .3 Sidewalk, 10M at 500mm each way, centered.
- .4 Edges of slabs and walls, 2-15M continuous, lap 400mm.
- .5 Opening in slab and wall over 300mm sq. 2-15m parallel to all edges, extending 600mm beyond corners.

3.3 CONSTRUCTION REVIEW

- .1 No concrete shall be placed until the Contract Administrator has completed his review of reinforcing in place. The Contractor shall provide a minimum of 24 hours notice of the time when the reinforcement will be substantially in place and ready for the Contract Administrator's review.

3.4 EPOXY COATED STEEL

- .1 Where noted on structural drawings, reinforcing shall be coated with a fusion bonded epoxy coating in accordance to ASTM A775-86.
- .2 With each batch of coating material, provide a written certification properly identifying batch number, material, quantity represented, date of manufacture, name and address of manufacturer and a statement that supplied coating material is the same composition as

that prequalified. A batch is defined as quality of coating material designated by the manufacturer in his production quality control program.

- .3 Coat cut ends of bars of epoxy coated reinforcing with epoxy patching material.
- .4 Use epoxy coated and/or plastic accessories and tie wire with epoxy coated reinforcement.

3.5 DAMAGE AND REPAIR TO EPOXY COATED REINFORCING

- .1 Repair coating damage with patching material if damaged area per 300mm is greater than nominal cross-sectional area of the bar. Damaged areas per 300mm, which are smaller than the nominal cross-section area of the bar, need not be repaired.
- .2 Limit repair of coating damage to bars on which total of damaged coating area does not exceed 5% of surface area of the bar within each bent area, or 3% of surface area of the bar within the total straight portion of coated bar.
- .3 Coated bars which do not meet the requirements of this specification shall be rejected. At coating applicators option, coated bars having defects shall be replaced or alternately, stripped of coating, re-cleaned, and recoated in accordance with the requirements of this specification.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Formwork
- .2 Section 03 20 00 - Concrete Reinforcing

1.2 MEASUREMENT PROCEDURES

- .1 Cast-in-place concrete will be measured in cubic metres calculated from neat dimensions indicated or authorized in writing by Contract Administrator. Concrete placed beyond dimensions indicated will not be measured.
- .2 No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, or piles.
- .3 No deductions will be made for volume of concrete less than 0.1m³ in volume displaced by individual drainage openings.
- .4 Cast-in-place concrete will not be measured but will be paid for as a fixed price item.
- .5 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to work.
- .6 Cooling of concrete and providing hot weather protection will not be measured but considered incidental to work.
- .7 Supply and installation of anchor bolts, nuts and washers and bolt grouting will not be measured but considered incidental to work.
- .8 Supply and installation of waterstops will be measured in lineal metres installed.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-02 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).
 - .2 ASTM C260-01, Specification for Air-Entraining Admixtures for Concrete.
 - .3 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .4 ASTM C494-04, Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C939-02 Test Method for Flow of Grout for Preplaced-Aggregate Concrete.
 - .6 ASTM D412-92, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
 - .7 ASTM D624-91, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .8 ASTM D1751-83 (1991), Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .9 ASTM D1752-84(1992), Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
- .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CGSB 81-GP-1M-77, Flooring, Conductive and Spark Resistant.
- .3 Canadian Standards Association (CSA)
 - .1 CSA A3000-03 Cementitious Materials Compendium
 - .2 CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
 - .3 CSA-A23.2-04, Methods of Test and Standard Practices for Concrete.
 - .4 CAN/CSA-A23.5-M86(R1992), Supplementary Cementing Materials. CSA A3000-03 Cementitious Materials Compendium
 - .5 CAN/CSA A363-M88(R1996), Cementitious Hydraulic Slag. CSA A3000-03 Cementitious Materials Compendium
- 1.4 CERTIFICATES
 - .1 Submit certificates in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Minimum 4 weeks prior to starting concrete work submit to Contract Administrator manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Blended hydraulic cement.
 - .3 Supplementary cementing materials.
 - .4 Grout.
 - .5 Admixtures.
 - .6 Aggregates.
 - .7 Water.
 - .8 Waterstops.
 - .9 Waterstop joints.
 - .10 Joint filler.
 - .3 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1-04.
 - .4 All concrete must be produced by a plant certified by the Manitoba ready Mix Concrete Association and a copy of a valid MRMCA Certification of Compliance submitted.
- 1.5 QUALITY ASSURANCE
 - .1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 01 45 00 - Quality Control for Contract Administrator's approval for following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.

- .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
- 1.6 WASTE MANAGEMENT AND DISPOSAL
- .1 Use excess concrete for additional paving.
 - .2 Use trigger operated spray nozzles for water hoses.
 - .3 Designate a cleaning area for tools to limit water use and runoff.
 - .4 Carefully coordinate the specified concrete work with weather conditions.
 - .5 Ensure emptied containers are sealed and stored safely for disposal away from children.
 - .6 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
 - .7 Choose least harmful, appropriate cleaning method which will perform adequately.
- PART 2 PRODUCTS**
- 2.1 MATERIALS
- .1 All concrete materials must satisfy requirements of CSA A23.1-04 except where noted.
- 2.2 MIXES
- .1 Proportion normal density concrete in accordance with CSA-A23.1-04, Alternative 1 to give the performance characteristics noted on the drawings.
- PART 3 EXECUTION**
- 3.1 PREPARATION
- .1 Obtain Contract Administrator's approval before placing concrete. Provide [24] hours notice prior to placing of concrete.
 - .2 Pumping of concrete will not be permitted.
 - .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
 - .4 Prior to placing of concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in adverse weather.
 - .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
 - .6 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
 - .7 Do not place load upon new concrete until authorized by Contract Administrator.
- 3.2 CONSTRUCTION
- .1 Do cast-in-place concrete work in accordance with CSA-A23.1-04.

- .2 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Contract Administrator.
 - .2 Where approved by Contract Administrator, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Contract Administrator.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.
 - .4 Check locations and sizes of sleeves and openings shown on drawings.
 - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts.
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval of Contract Administrator, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100mm diameter. Drilled holes to be to manufacturer's recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with epoxy grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage holes and weep holes:
 - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.
- .5 Dovetail anchor slots:
 - .1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.
 - .2 Install continuous vertical anchor slots at 800 mm o/c where concrete walls are masonry faced.
- .6 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .7 Finishing.
 - .1 Finish concrete in accordance with CSA-A23.1-04.
- .8 Joint fillers.

- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Contract Administrator. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .2 Locate and form construction and expansion joints as indicated. Install joint filler.
 - .3 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- .9 Dampproof membrane.
- .1 Install dampproof membrane under concrete slabs-on-grade inside building.
 - .2 Lap dampproof membrane minimum 150 mm at joints and seal.
 - .3 Seal punctures in dampproof membrane before placing concrete. Use patching material at least 150 mm larger than puncture and seal.
- 3.3 SITE TOLERANCE
- .1 Concrete tolerance in accordance with CSA-A23.1-04 straight edge method.
- 3.4 FIELD QUALITY CONTROL
- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory certified by CSA A283 and designated by The City in accordance with CSA-A23.1-04 and Section 01 45 00 - Quality Control.
 - .2 The City will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures: Testing Laboratory Services.
 - .3 Additional test cylinders required during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
 - .4 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2-04.
 - .5 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

PART 1 GENERAL

1.1 RELATED SECTIONS

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

1.2 DESCRIPTION OF WORK INCLUDED

- .1 Provide all labour, materials, equipment and services to supply and erect structural steel and open web steel joists required and/or indicated on the drawings or specified herein, including the supply of embedded steel parts which will form the connection between the structural steel and poured-in-place concrete and reinforcement of steel deck openings larger than 18 inches. Report any discrepancies between structural, mechanical, electrical and architectural drawings to the Contract Administrator immediately.

1.3 QUALITY ASSURANCE

- .1 Structural steel work shall conform to the following standards:
- .1 Provincial Building Code - current Edition.
 - .2 CSA Standard CAN/CSA-S16.1-01 (LIMIT STATES DESIGN OF STEEL STRUCTURES).
 - .3 CSA Standards CAN/CSA-W47.1-03 (CERTIFICATION OF COMPANIES FOR FUSION WELDING OF STEEL STRUCTURES).
 - .4 CSA Standards W59-03 (WELDED STEEL CONSTRUCTION) (METAL ARC WELDING).
- .2 Copies of the above publications shall be available from the Contractor at the job site at all times.

1.4 QUALIFICATIONS OF CONTRACTOR

- .1 Structural steel fabricator shall have not less than five (5) years experience in the fabrication of structural steel.
- .2 Erector shall have not less than five (5) years experience in erection of structural steel.
- .3 The steel fabricators and erectors must be certified under the requirements of CAN/CSA W47.1 as required by CAN/CSA-S16-01.
- .4 Welding procedures, welders and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

1.5 SUBMITTALS & SHOP DRAWINGS

- .1 Submit detailed erection and shop drawings prepared under the supervision of a Registered Professional Engineer in accordance with the General Conditions. Where pre-engineered or fabricator designed elements are part of the shop drawings, the shop drawings shall be stamped by a professional engineer licensed to practice in the applicable province.
- .2 The shop drawings shall clearly show all shop and erection details, including cuts, copes, connections, holes, threaded fasteners, splices and welds. All welds, both shop and field, shall be indicated by AWS Welding Symbols as specified in CSA Standard W59 Appendix D and E.
- .3 Provide setting drawings, templates and directions for the installation of anchor bolts plates and other devices.

- .4 Prior to starting erection work, submit a description of the methods, sequence of erection and type of equipment proposed for in erecting structural steel.
 - .5 Joist drawings shall show joist eccentricity limits at maximum fabrication tolerances as described in the Open-Web Steel Joist Clause of CAN3-S16.1-04.
- 1.6 PRODUCT HANDLING
- .1 Storage of Materials:
 - .1 Structural steel members shall be stored at the site above ground on platforms, skids or other devices.
 - .2 Steel shall be protected from corrosion.
 - .3 Other materials shall be stored in a weather tight and dry place until ready for use in the Work.
 - .4 Packaged materials shall be stored in their original unbroken packages or containers.
- 1.7 SUPPLY OF ALTERNATE PRODUCTS
- .1 Should the rolled sections shown on the drawings not be procurable from Canadian Mills, or should substitution for those sections be desired, sections of equivalent strength, may be substituted if approved by the Contract Administrator in accordance with B6.
- 1.8 TESTING AND INSPECTION
- .1 A testing agency will be selected and paid as specified in the General Conditions.
 - .2 Prior to the commencement of work, provide shop fabrication and erection schedules.
 - .3 On request, submit certified mill tests in accordance with the standards.
 - .4 The Contractor shall advise the testing agency of the scheduling of all shop and field work pertaining to this Project. The Contractor shall permit the testing agency full access to the fabrication shop and the site for the purpose of carrying out his work and he shall provide assistance required to aid in the performance of the inspection and testing.
 - .5 Testing of all connections and splices not indicated on the design drawings shall be undertaken by The City's Testing Agency and will be to the Contractor's account.
- PART 2 PRODUCTS**
- 2.1 MATERIALS
- .1 Structural Steel shall be in accordance with CSA Standard G40.21. Wide Flanges shall be Grade 350W, hollow structural sections shall be Grade 350W Class C, and steel plates and miscellaneous sections shall be 300W.
 - .2 Welding materials shall be in accordance with CSA Standard W59.
 - .3 Threaded fasteners to ASTM Specification A325 or A490.
 - .4 Anchor bolts to ASTM Specification A307 or better.
 - .5 Embedment anchors shall be Nelson headed anchors with fluxed ends or approved equal in accordance with B6 conforming to ASTM. A.108-73.
 - .6 Bar anchors shall be Nelson deformed bar anchors or approved equal in accordance with B6 conforming to ASTM.A-496.

- .7 Brick support angles and related framing materials exposed to weather, shall be galvanized Z275 G90 designation.
- .8 Primers for interior exposure not to receive a shop or field paint finish shall be CISC/CPMA Standard 1-73a Primer or other pre-approved.
- .9 Primers for exterior exposure not to receive a shop or field paint finish shall be zinc chromate Type - 1, conforming to CGSB 1-GP-40d.
- .10 Primers used in a multi-coat system where a final shop or field paint finish is to be applied shall be selected and pre-approved based on surface preparation, exposure conditions and compatibility with subsequent coatings.

2.2 FABRICATION

- .1 Unless otherwise indicated, fabrication of structural steel shall be in accordance with CSA Standard CAN/CSA-S16-01.
- .2 Verify all dimensions and take necessary field measurements before fabrication.
- .3 Provide punched holes for the convenience of other trades in attaching wood blocking or other materials. Coordinate with drawings of other disciplines for locations and details.
- .4 Obtain Contract Administrator's approval for holes required through structural steel that are not shown on the drawings.

2.3 WELDING

- .1 Appearance, quality of welds made, methods of correcting defective work shall be in accordance with CSA Standard W59.
- .2 Prepare surfaces for welding either by leaving unpainted or remove paint.
- .3 Embedment anchors, shear studs and deformed bar anchors shall be automatically end welded with suitable stud welding equipment in accordance to the manufacturer's recommendations. Fillet welding of anchors will be rejected.

2.4 SHOP PAINTING

- .1 Steel shall be painted with shop primer meeting the requirements of CSA Standard CAN/CSA-S16.1 unless noted otherwise.
 - .1 Architecturally Exposed Steel:
- .2 Cleaning, preparation of steel and the paint product shall be compatible with requirements of finish painting.
- .3 Use paint as prepared by manufacturer without thinning or adding admixtures. Execute painting on dry surfaces, free from rust, scale, and grease. Do not paint in temperatures lower than 8 deg. C.
- .4 Interior structural steel - steel surfaces to be encased in concrete, welded, fireproofed, zinc coated, galvanized or to receive shear connector studs or embedment anchors shall not be painted.
- .5 Clean contact surfaces by effective means before assembly, but do not paint.
- .6 Where shop painting is required give two coats of paint (preferably of different colours) to parts inaccessible after final assembly.
- .7 Touch-up welds, bolts, and burnt or scratched surfaces of painted steel after completion of erection.

2.5 COLUMNS AND BASES

- .1 All flame cut steel columns shall have their ends milled. Steel base plates supporting columns shall be flat.
- .2 Base plates and cap plates are to be seal welded to HSS columns.

2.6 CONNECTIONS

- .1 Use connections of the type and detail shown on the drawings. Modifications to the specified connection types and details will not be permitted without prior approval from the Contract Administrator.
- .2 Connections designed by the fabricator shall be in accordance with CSA Standard CAN/CSA-S16.1 and stamped and sealed by a Professional Engineer registered in the applicable province.
- .3 All connections shall be designed to carry the loads specified on the drawings. If loads are not given, the connection shall have a capacity not less than the members being connected.
- .4 Column to beam and girder connections shall allow for a horizontal stability force in all directions equal to 2% of the design column axial load in addition to all other loads.
- .5 Structural steel members spliced for ease of fabrication or transportation shall have splices designed to develop the full strength and stiffness of the member. Splices shall be subject to non-destructive testing as directed by the Contract Administrator. The cost for such testing shall be borne by the Contractor.
- .6 Use standard connection types where possible.
- .7 Provide stiffeners in beam webs at all locations of beam continuity. Unless noted otherwise web stiffeners shall be 12mm minimum.
- .8 All bolted connections may be snug tight except connections for:
 - .1 Bracing, trusses and drag struts.
 - .2 Elements resisting crane loads.
 - .3 Supports for running machines or loads that produce impact or cyclic load.
 - .4 These shall be designed as slip resistant connections and pretensioned.
- .9 Connections for lateral load resisting elements, bolts in tension, and elements connected with oversize or slotted holes unless designed to accommodate movement may be bearing connections but shall be pretensioned.

2.7 SEPARATORS AND MISCELLANEOUS SUPPORTS

- .1 Provide separators for all double members in accordance with CSA Standard CAN/CSA-S16.1.
- .2 Provide plates and/or angles for support of masonry where required.

2.8 ERECTION

- .1 The erector is fully responsible for erection methods, equipment, workmanship and safety precautions.
- .2 Erect structural steel plumb, true and with all necessary precautions against damage of any kind to the material and to the structure. Report every failure of members to come

- properly together and any measures taken for correction shall be submitted to the Contract Administrator for review.
- .3 Confirm the setting of anchor bolts and bearing plates and make an instrument survey to verify the setting prior to erection of steel members.
 - .4 Cutting or burning of base plates to accommodate misplaced anchor bolts is not permitted.
 - .5 Provide and install temporary bracing as required to keep the structure plumb and in true alignment during construction. Assume complete responsibility for the extent and timing of the removal of such bracing. The bracing members indicated on the drawings are required for the finished structure and shall not be considered as adequate for temporary bracing. Any failure to make proper and adequate provision for stresses occurring during the erection from any causes whatsoever shall be entirely the responsibility of the Contractor.
 - .6 Structural steel frames shall be accurately assembled to the lines and elevations indicated within the specified tolerances.
 - .7 The various members forming parts of complete frame structure after being assembled shall be aligned and adjusted accurately before being fastened.
 - .8 Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.
 - .9 Temporary bolts, clips and angles etc., used to facilitate erection shall be removed unless noted otherwise on the drawings.

2.9 TEMPORARY FLOORING

- .1 Provide all temporary flooring, planking and scaffolding necessary in connection with erection of structural steel, or support of erection machinery in accordance with governing regulations or by-laws.

PART 3 EXECUTION

3.1 COMPLETION

- .1 The Registered Professional Engineer responsible for the sealed shop drawings, or his representative shall visit the site to review in place connections and components designed by that Registered Professional Engineer as required to substantiate compliance with his sealed shop drawings. He shall then submit a letter of compliance provide a sealed and signed letter to the Contract Administrator.
- .2 On completion of the work of this section, all protection erected in conjunction with the structural steel work shall be removed, all damage to this work and adjoining work shall be made good and all surplus materials and debris and all tools, plant and equipment shall be removed from the site.

3.2 FIELD QUALITY CONTROL

- .1 Structural steel work (material and workmanship) shall be subject to review and tests by a testing agency retained by The City.
- .2 Construction review by the testing agency or the Contract Administrator does not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with the drawings and specifications.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Architectural Woodwork Section 06 41 11

1.2 SOURCE QUALITY CONTROL

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards

PART 2 PRODUCTS

2.1 LUMBER MATERIAL

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards"

- .1 CSA 0141-1970.
- .2 NLGA Standard Grading Rules for Canadian Lumber, 1987 edition. This designates dry lumber and is stamped S-dry.

- .2 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:

- .1 S2S is acceptable for all items.
- .2 Board sizes: "Standard" or better grade.
- .3 Dimension sizes: "Standard" light framing or better grade.
- .4 Post and timber sizes: "Standard" or better grade.

- .3 Machine stress rated lumber is acceptable for all purposes.

- .4 Glued end-joined or finger-joined lumber is not acceptable.

2.2 FASTENERS

- .1 Nails, spikes and staples: to CSA B111-1974.

- .2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

- .4 Galvanizing: to CSA G164-M1981, use galvanized fasteners for exterior Work, interior highly humid areas, pressure-preservative, fire retardant treated lumber.

- .5 Joist hangers: minimum, 1 mm 20 ga thick sheet steel, galvanized ZF001 coating designation, minimum 6672 N bearing strength.

- .6 Nailing discs: flat caps, minimum 25 mm diameter, 1" diameter, minimum 0.4 mm 27 ga. Thick sheet metal formed to prevent dishing. Bell or cup shapes not acceptable.

2.3 WOOD PRESERVATIVE

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

PART 3 EXECUTION

3.1 CONSTRUCTION

- .1 Comply with requirements of NBC 2005, Part 9, supplemented by the following paragraphs.

3.2 ERECTION OF FRAMING MEMBERS

- .1 Install members true to line, levels, and elevations.
- .2 Construct continuous members from pieces of longest, practical length.
- .3 Install spanning members with 'crown edge' up.

3.3 FURRING AND BLOCKING

- .1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other Work as required.
- .2 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .3 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.

3.4 NAILING STRIPS, GROUNDS, AND ROUGH BUCKS

- .1 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other Work.

3.5 FASTENERS

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity. Countersink bolts where necessary to provide clearance for other Work.

3.6 ELECTRICAL EQUIPMENT BACKBOARD

- .1 Provide backboards for mounting electrical equipment as required. Use 19 mm thick plywood on 19 x 38 mm furring around perimeter and at maximum 300 mm intermediate spacing.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Architectural Woodwork: Architectural Woodwork Section 06 41 11
- .2 Plastic Laminates: Laminated Plastic Work Section 06 41 12
- .3 Painting Section 09 91 10

1.2 REFERENCE

- .1 American National Standards Institute (ANSI).
 - .1 ANSI A208.1-1989, Particleboard, Matformed Wood.
 - .2 ANSI A208.2-1994, Medium Density Fibreboard (MDF).
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
 - .1 AWMAC Quality Standards for Architectural Woodwork 2003.
- .3 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-11.3-M87, Hardboard.
- .4 Canadian Standards Association (CSA).
 - .1 CSA B111-1974, Wire Nails, Spikes and Staples.
 - .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA O115-M1982, Hardwood and Decorative Plywood.
 - .4 CSA O121-M1978, Douglas Fir Plywood.
 - .5 CAN/CSA O141-91, Softwood Lumber.
 - .6 CSA O151-M1978, Canadian Softwood Plywood.
 - .7 CSA O153-M1980, Poplar Plywood.
- .5 National Hardwood Lumber Association (NHLA).
 - .1 Rules for the Measurement and Inspection of Hardwood and Cypress January 1986.
- .6 National Lumber Grades Authority (NLGA).
 - .1 Standard Grading Rules for Canadian Lumber 1996.
- .7 Underwriters Laboratories of Canada (ULC).
 - .1 CAN4-S104-M80(R1985), Fire Tests of Door Assemblies
 - .2 CAN4-S105-M85, Fire Door Frames.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
- .3 Indicate all materials, thicknesses, finishes and hardware.

- 1.4 SAMPLES
 - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- 1.5 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-S104M and CAN4-S105M for ratings specified or indicated.
- 1.6 DELIVERY, STORAGE AND HANDLING
 - .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 – Product Requirements.
 - .2 Protect materials against dampness during and after delivery.
 - .3 Store materials in ventilated areas, protected from extreme changes of temperature or humidity.
- PART 2 PRODUCTS**
- 2.1 LUMBER MATERIAL
 - .1 Softwood lumber: unless specified otherwise, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC custom grade, moisture content as specified.
 - .2 Machine stress-rated lumber is acceptable for all purposes.
 - .3 Hardwood lumber: moisture content 6% or less in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC custom grade, moisture content as specified.
 - .4 Manufacturing process must adhere to Lifecycle Assessment (LCA) Standards as per ISO 14040/14041 LCA Standards.
- 2.2 PANEL MATERIAL
 - .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .3 Hardwood plywood: to CSA O115.
 - .4 Poplar plywood (PP): to CSA O153, standard construction.
 - .5 Particleboard: to ANSI A208.1-99.
 - .6 Low density fibreboard: to CAN3-A247M.
 - .1 Ensure fibreboard is not manufactured with binders, coatings or adhesives which contain resins or other compounds that have potential to release formaldehyde during final product's use.
 - .7 Manufacturing process must adhere to Lifecycle Assessment Standards as ISO 14040/14041 LCA Standards.

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: to CSA B35.4 plain, type and size to suit application.
- .3 Splines: wood.
- .4 Adhesive: recommended by manufacturer such that formaldehyde emissions do not exceed 0.05 ppm 180 sq. g/m³.
- .5 Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this 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 Install hardware in accordance with manufacturer's instructions and requirements of Canadian Steel Door and Frame Manufacturers Association.
 - .4 Use the templates provided by hardware item manufacturer.
- .2 Wood Doors.
 - .1 Install doors in accordance with manufacturer's instructions.
 - .2 Machine cut relief for hinges and coring for handsets and cylinders.
 - .3 Trim door width by cutting equally on both jambs. Trim fire door width from lock edge only, to a maximum of 5mm.
 - .4 Trim door height by cutting equally on top and bottom edges to a maximum of 19mm. Trim fire door height at bottom edge only, to a maximum of 15mm.
 - .5 Undercut doors to a maximum of 6mm above finished floor.
 - .6 Prepare doors to receive finish hardware in accordance with AWMAC requirements.
 - .7 Conform to AWMAC requirements for fit tolerances. Maximum diagonal distortions: 1.5mm measured with straight edge, corner to corner.
 - .8 Coordinate installation of glass and glazing. Install door louvers, as called for on Door schedule or on Mechanical Drawings.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Plastic Laminates Section 06 41 12
- .2 Joint Sealers Section 07 92 00

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM E 1333-90, Standard test method for determining formaldehyde levels from wood products under defined test conditions using a large chamber.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
 - .1 AWMAC Quality Standards for Architectural Woodwork 2003.
- .3 Canadian Standards Association (CSA).
 - .1 CAN3-A172-M79, High Pressure Paper Base, Decorative Laminates.
 - .2 CSA B111-1974, Wire Nails, Spikes and Staples.
 - .3 CSA O115-M1982, Hardwood and Decorative Plywood.
 - .4 CSA O121-M1978, Douglas Fir Plywood.
 - .5 CAN/CSA O141-91, Softwood Lumber.
 - .6 CSA O151-M1978, Canadian Softwood Plywood.
 - .7 CSA O153-M1980, Poplar Plywood.
 - .8 CAN/CGSB-11.3-M87, Hardboard.
- .4 National Hardwood Lumber Association (NHLA).
 - .1 Rules for the Measurement and Inspection of Hardwood and Cypress January 1996.
- .5 National Lumber Grades Authority (NLGA).
 - .1 Standard Grading Rules for Canadian Lumber 1991.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .1 Scale: profiles, details ½ full size.
- .3 Indicate all materials, thicknesses, finishes and hardware.
- .4 Indicate locations of all service outlets in casework, typical and special installation conditions, and all connections, attachments, anchorage and location of exposed fastenings.

1.4 QUALITY ASSURANCE

- .1 Perform Work in accordance with Custom Grade quality.
- .2 Work in this Section shall comply with the specified Grade of Work and Sections of the current edition of the AWI/AWMAC Quality Standard Illustrated.

1.5 QUALIFICATIONS

- .1 Contractors and their personnel engaged in the Work shall be able to demonstrate successful experience with Work of comparable extend, complexity and quality to that shown and specified.
- .2 Manufacturers who are members in good standing of the Architectural Woodwork institute (AWI) or the Architectural Woodwork Manufacturers Association of Canada (AWMAC) and are familiar with this Standard.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle, store and protect materials of this section in accordance with General Conditions for Construction Contracts.
- .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.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 15% or less in accordance with following standards:
 - .1 CAN/CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC custom grade, moisture content as specified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Hardwood lumber: moisture content 7% or less in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC custom grade, moisture content as specified.
- .4 Douglas fir plywood (DFP); to CSA O121, standard construction.
- .5 Canadian softwood plywood (CSP); to CSA O151, standard construction.
- .6 Hardwood plywood: to CSA O115.
- .7 Poplar plywood (PP): to CSA O153, standard construction.
- .8 Melamine: to CAN3-0188.1 Grade R; density 720 kg/m³. Melamine finish to NEMA LQ1, minimum 120 gram weight, thermally fired both sides to both sides of Woodstark. Colour: Standard Grey.
- .9 Nails and staples: to CSA B111.
- .10 Wood screws: steel, type and size to suit application.
- .11 Splines: wood, plastic or metal.
- .12 Door and drawer pulls: Hafele – Steel handles – nickel-plated matt CST # 117.31.632 153x30x128.
- .13 Sealant: in accordance with 07 92 00 - Joint Sealers.

- .14 The manufacturing process must adhere to Lifecycle Assessment (LCA) Standards as per ISO 14040/14041 LCA Standards.
- 2.2 CABINET HARDWARE
 - .1 Hinges
 - .1 Concealed (European) hinge: self-closing zinc die-cast hinge with six-way adjustment and screw-in hinge cup, 170° opening angle, attached with a two-piece, height adjustable screw-in mounting plate, nickel finish.
 - .1 Blum CLIP 170°
 - .2 Mepla-Alfit SSP61 170°
 - .2 Shelf Supports
 - .1 Knappe & Vogt 80/180 standards & brackets and chrome finish.
 - .3 Standard Box Drawer Slides: standard-duty, 125 lb. load capacity
 - .1 Side-Mounted Full-Extension Drawer Slides – ball bearing, finish to be selected by Contract Administrator.
 - .1 Accuride 3017
 - .2 Knappe & Vogt 8500
 - .3 Waterloo 3290
 - .4 Door and Drawer Bumpers
 - .1 Door and Drawer Bumpers: nylon, 7 mm diameter (nominal) install in pairs, clear
 - .1 Blum 993.710
 - .2 Mepla-Alfit 630.000.03.07
- 2.3 MANUFACTURED UNITS
 - .1 Casework.
 - .1 Fabricate caseworks to AWMAC custom quality grade.
 - .2 Furring, blocking, nailing strips, grounds and rough bucks and sleepers.
 - .1 S2S is acceptable.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
 - .3 Framing SPF species, NLGA #1 grade, para.
 - .4 Case bodies (ends, divisions and bottoms).
 - .1 Particleboard, square edge, 19mm thick, standard grey melamine finish.
 - .5 Backs.
 - .1 Particleboard, square edge, 13mm thick, standard grey melamine finish.
 - .6 Shelving.
 - .1 Particleboard, square edge, 16mm thick, standard grey melamine finish.

- .2 Drawers.
 - .1 Fabricate drawers to AWMAC custom grade supplemented as follows:
 - .2 Sides and Backs.
 - .1 Particleboard, square edge, 19mm thick, standard grey melamine finish.
 - .3 Bottoms.
 - .1 Particleboard, square edge, 19mm thick, standard grey melamine finish.
 - .4 Fronts.
 - .1 Particleboard, 19mm thick, Plastic Laminate – Standard Finish - colour to be selected after Award of Contract.
- .3 Casework Doors.
 - .1 Fabricate doors to AWMAC custom grade supplemented as follows:
 - .2 Particleboard, 19mm thick, Plastic Laminate – Standard Finish - colour to be selected after Award of Contract
- 2.4 FABRICATION
 - .1 Set nails and countersink screws, apply plain wood filler to indentations, sand smooth and leave ready to receive finish.
 - .1 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
 - .2 Shelving to cabinetwork to be adjustable unless otherwise noted.
 - .3 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
 - .4 Shop assemble Work for delivery to site in size easily handled and to ensure passage through building openings.
- 2.5 FINISHING
 - .1 Sand Work smooth and set exposed nails and screws.
 - .1 For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.
 - .2 For transparent finishes, use wax or burn-in filler which blends with surrounding colour and sheen, often after stain and before final top coat.
 - .3 Prime paint surfaces in Contract with cementitious materials.
- PART 3 EXECUTION**
- 3.1 INSTALLATION
 - .1 Do architectural woodwork to Custom Grade 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.
 - .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 bituminous coating over wood framing members in contact with masonry or cementitious construction.
 - .8 Fit hardware accurately and securely in accordance with manufacturer's directions.
- 3.2 CLEANING
- .1 Clean all millwork and cabinet Work inside and outside surfaces.
- 3.3 PROTECTION
- .1 Protect millwork and cabinet Work from damage until final inspection.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Finish Carpentry Section 06 20 00
- .2 Architectural Woodwork Section 06 41 11

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM D 2832-92(R1994), Standard Guide for Determining Volatile and Non-volatile Content of Paint and Related Coatings.
 - .2 ASTM D 5116-90, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN3-O188.1-M78, Interior Mat-Formed Wood Particleboard.
 - .2 CAN3-O188.3-M82, Exterior Bond Mat-Formed Wood Particleboard.
 - .3 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .3 Canadian Standards Association (CSA).
 - .1 CAN3-A172-M79, High Pressure, Paper Base, Decorative Laminates.
 - .2 CSA O112.4-M1977, Standards for Wood Adhesives.
 - .3 CSA O112.5-Series-M-1977, Urea Resin Adhesives for Wood (Room-and High-Temperature Curing).
 - .4 CSA O112.7-Series M-1977, Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room-and Intermediate-Temperature Curing).
 - .5 CSA O121-M1978, Douglas Fir Plywood.
 - .6 CAN/CSA O141-91, Softwood Lumber.
 - .7 CSA O151-M1978, Canadian Softwood Plywood.
 - .8 CSA O153-M1980, Poplar Plywood.
- .4 Environmental Choice Program (EPC).
 - .1 ECP-44-92, Adhesives.
 - .2 ECP-45-92, Sealants and Caulking Compounds.
 - .3 ECP-67-95, Recycled Water-borne Surface Coatings.

1.3 SAMPLES

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

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for laminate Work for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.

1.5 STORAGE AND PROTECTION

- .1 Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00 – Basic Product Requirements.
- .2 Maintain relative humidity between 25 and 60% at 22°C during storage and installation.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Laminated plastic for flatwork: to CAN3-A172, Grade GP, 1.2mm thick; based on solid, woodgrain, or printed pattern colour range with standard finish. For counter top only, Wilsonart HD Premium Finish (Colour to be selected later).
- .2 For edges, Wilsonart HD Premium Decorative Edging.
- .3 Laminated plastic backing sheet: Grade BK, not less than 0.5mm thick or same thickness as face laminate.
- .4 Particleboard core: to CAN3-O188.1, sanded faces, of thickness indicated.
- .5 Laminated plastic adhesive: low VOC as recommended by laminate manufacturer.
 - .1 Test for acceptable VOC emissions in accordance with ASTM D 2369 and ASTM D 2832.
 - .2 Acceptable materials: ECP-44.
- .6 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.
 - .1 Test for acceptable VOC emissions in accordance with ASTM D 2369 and ASTM D 2832.
 - .2 Acceptable materials: ECP-67.
- .7 Sealants: as recommended by laminate manufacturer.
 - .1 Test for acceptable VOC emissions in accordance with ASTM D 2369 and ASTM D 2832.
 - .2 Acceptable materials: ECP-45.
- .8 Draw bolts and splines: as recommended by fabricator.

2.2 FABRICATION

- .1 Comply with CAN3-A172, Appendix 'A'.
- .2 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .3 Ensure adjacent parts of continuous laminate Work match in colour and pattern.
- .4 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 2400 mm. Keep joints 600 mm from sink cutouts.
- .5 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- .6 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamber exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

- .7 Apply laminate backing sheet to reverse side of core of plastic laminate Work.
- .8 Apply laminated plastic liner sheet where indicated.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install Work plumb, true and square, neatly scribed to adjoining surfaces.
- .2 Make allowances around perimeter where fixed objects pass through or project into laminated plastic Work to permit normal movement without restriction.
- .3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm oc, 75 mm from edge. Make flush hairline joints.
- .4 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamber edges and seal exposed core.
- .5 At junction of laminated plastic counter black splash and adjacent wall finish, apply small bead of sealant.
- .6 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.
- .7 For site application, offset joints in plastic laminate facing from joints in core.

3.2 PROTECTION

- .1 Cover finished laminated plastic, wood, and metallic veneered surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.

PART 1

GENERAL

1.1

REFERENCES

- .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB 37.3-M89, Application of Emulsified Asphalts for Dampproofing or Waterproofing.
 - .3 CAN/CGSB 37.5-M89, Cement, Plastic, Cutback Asphalt.
 - .4 CGSB 37-GP-6Ma-83, Asphalt, Cutback, Unfilled, for Dampproofing.
 - .5 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
 - .6 CGSB 37-GP-11M-76(R1984), Application of Cutback Asphalt Plastic Cement.
 - .7 CGSB 37-GP-12Ma-84, Application of Unfilled Cutback Asphalt for Dampproofing.
 - .8 CGSB 37-GP-15M-76(R1984), Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
 - .9 CAN/CGSB 37.16-M89, Filled, Cutback, Asphalt, for Dampproofing and Waterproofing.
 - .10 CAN/CGSB 37.28-M89, Reinforced, Mineral Colloid Type Emulsified, Asphalt for Roof Coatings and for Waterproofing.
 - .11 CGSB 37-GP-36M-76, Application of Filled Cutback Asphalts for Dampproofing and Waterproofing.
 - .12 CGSB 37-GP-37M-77, Application of Hot Asphalt for Dampproofing or Waterproofing.
- .2 Canadian Standards Association (CSA).
 - .1 CSA A123.4-M1979(R1992), Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.

1.2

SUBMITTALS

- .1 Submit proof of manufacturer's CCMC Listing and listing number to Contract Administrator.
- .2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

1.3

PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit WHMIS MSDS – Material Safety Data Sheets. WHMIS acceptable to Labour Canada and Health and Welfare Canada.
- .3 Submit product data sheets for bituminous Dampproofing products. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.

.3 Application methods.

.4 Limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00 – Product Requirements.

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

.3 Store materials on supports to prevent deformation.

.4 Remove only in quantities required for same day use.

.5 Store materials in accordance with manufacturer's written instructions.

1.5 PROJECT/SITE ENVIRONMENTAL REQUIREMENTS

.1 Temperature, relative humidity, moisture content.

.1 Apply dampproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

.2 Do not proceed with Work when the wind chill effect would tend to set bitumen before proper curing takes place.

.3 Maintain air temperature and substrate temperature at dampproofing installation area above 5°C for 24 hours before, during and after installation.

.4 Do not apply dampproofing in wet weather.

.2 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of asphalt, sealing compounds, primers and caulking materials.

.3 Ventilation:

.1 Ventilate area of Work as directed by Contract Administrator.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Asphalt:

.1 Acceptable materials: "Bakelite 710-11", "SCP Insul-Mastic 7101", or approved equal in accordance with B6.

.2 Asphalt primer: to CAN/CGSB-37.2.

.1 Acceptable materials: "Bakelite 910-01", "SCP Insul-Mastic 7501", compatible with substrate or approved equal in accordance with B6.

PART 3 EXECUTION

3.1 WORKMANSHIP

.1 Keep hot asphalt:

.1 Below its flash point.

.2 At or below its final blowing temperature.

.3 Within its equiviscous temperature range at place of application.

3.2 PREPARATION

.1 Before applying dampproofing:

.1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound.

3.3 APPLICATION

.1 Do dampproofing in accordance with CAN/CGSB-37.3 except where specified otherwise.

.2 Do sealing Work in accordance with CGSB 37-GP-11M except where specified otherwise.

.3 Do priming of surface in accordance with CGSB 37-GP-15M except where specified otherwise.

.4 Apply primer.

.5 Apply dampproofing in accordance with applicable CGSB application standard.

Material		Application
CAN/CGSB-37.2	use	CAN/CGSB-37.3
CGSB 37-GP-6Ma	use	CGSB-37-GP-12M
CAN/CGSB-37.16	use	CGSB-37-GP-36M
CAN/CGSB-37.28	use	CAN/CGSB-37.3
CSA A123.4	use	CGSB-37-GP-37M

3.4 SCHEDULE

.1 Apply continuous, uniform coating to entire exterior faces of foundation walls from 50 mm below finished grade level to and including tops of foundation wall footings unless indicated otherwise.

.2 Apply continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Include exterior portion of interior walls where floors in adjacent rooms are at different elevations.

.3 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 230 mm along pipes and through walls.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Vapour and Air Barriers Section 07 27 00

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
- .1 ASTM E96-96, Test methods for Water Vapour Transmission of Materials.
 - .2 ASTM C208-95, Standard Specification for Cellulosic Fibre Insulating Board.
 - .3 ASTM C591-94, Standard Specification for Unfaced Preformed Rigid Polyisocyanurate Thermal Insulation.
 - .4 ASTM C726-93, Standard Specification for Mineral Fibre Roof Insulation Board.
 - .5 ASTM C728-97, Standard Specification for Perlite Thermal Insulation Board.
 - .6 ASTM C1126-98, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
 - .7 ASTM C1289-98, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- .2 Canadian Gas Association (CGA)
- .1 CAN/CGA-B149.1-M95, Natural Gas Installation Code.
 - .2 CAN/CGA-B149.2-95, Propane Installation Code.
- .3 Canadian General Standards Board (CGSB)
- .1 CGSB 71-GP-24M-77, Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.
- .4 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S701-97, Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
 - .2 CAN/ULC-S702-97, Thermal Insulation, Mineral Fibre, for buildings.

PART 2 PRODUCTS

2.1 INSULATION

PROPERTIES	TYPE				
	1	2	3	4	5
Thermal Resistance Minimum (R-Value/inch)	3.7	4.0	4.75	5	4.2
Moisture Absorption Maximum (% by Volume)	6%	4%	<2%	<1%	<1%
Compressive Strength Minimum (psi)	8psi	16psi	20psi	30psi	-
Flexural Strength Minimum (psi)	25psi	35psi	44psi	50psi	-
Standard of Acceptance	Beadboard Expanded Polystyrene I	Cladmate* Wallmate* Deckmate* Expanded Polystyrene II	Styrospan* Cavitymate* Cavitymate Ultra* Cellfort 200	Styrofoam*SM Perimate* HI-40-60-100 Roofmate*CT Cellfort 300	Roxul Curtain Rock FBX 1240 Fibrex

2.2 ADHESIVE

- .1 Adhesive (for polystyrene): to CGSB 71-GP-24, Type Bulldog Wetstick/Bulldog Grip PL 200.

2.3 ACCESSORIES

- .1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

PART 3 EXECUTION

3.1 WORKMANSHIP

- .1 Install insulation after building materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys or as required by code, whichever is more stringent.

- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
 - .6 Offset both vertical and horizontal joints in multiple layer applications.
 - .7 Do not enclose insulation until it has been inspected and approved by Contract Administrator.
- 3.2 EXAMINATION
- .1 Examine substrates and immediately inform Contract Administrator in writing of defects.
 - .2 Prior to commencement of Work ensure:
 - .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.
- 3.3 RIGID INSULATION INSTALLATION
- .1 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.
 - .2 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm polyethylene strip over expansion and control joints using compatible adhesive before application of insulation.
- 3.4 PERIMETER FOUNDATION INSULATION
- .1 Exterior application: extend boards full height of grade beams as indicated. Install on exterior face of perimeter foundation wall with adhesive.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation methods required for installation of the primary spray-applied Rigid Polyurethane Foam material.

1.2 REFERENCES

- .1 CAN/ULC-S705.1-98 (replaces CAN/CGSB-51.23-92): Standard for Thermal Insulation – Spray-Applied Rigid Polyurethane Foam, Medium Density, Material Specification.
- .2 CAN/ULC-S705.2-98 (replaces CAN/CGSB-51.39-92): Standard for Thermal Insulation – Spray-Applied Rigid Polyurethane Foam, Medium Density, Installer’s Responsibilities-Specification.
- .3 CCMC 12877-R – Evaluation of BASF WALLTITE as an air barrier material.

1.3 TEST RESULTS

- .1 Submit the following prior to commencing the work:
 - .1 Test reports verifying that qualities of insulation meet or exceed requirements of this specification, in accordance with Section 01 45 00 – Quality Control.
 - .2 Name of installer complete with proof (certification card) that installer is licensed or approved by the Quality and Training Program – Raising Performance To New Heights by BASF and certified by Morrison Hershfield, to perform the installation of WALLTITE

1.4 PROTECTIVE MEASURES

- .1 Ensure the work area is adequately ventilated, in compliance with requirements set out in Section 01500 – Temporary Installation.
- .2 Ensure continuous and proper ventilation of the work area, through a fresh air intake and the extraction of foul air, during the course of the application process and for 24 hours thereafter.
- .3 When necessary, install temporary partitions in order to prevent any over spray outside of the work area from the sprayed on insulation material.
- .4 Ensure all structures are well protected, in accordance with the manufacturer’s recommendations.
- .5 Protect all adjacent surfaces and equipment against any damage that may be caused by dispersion and over spray of insulation material beyond prescribed limits.
- .6 When cleaning equipment, it should be performed in areas designated for this purpose, and the contents of the empty containers neutralized according to the procedure established by the CAN/ULC-S705.2-98.

1.5 DELIVERY, STORAGE & HANDLING

- .1 All materials should be delivered and stored in their original packaging bearing the manufacturer’s name, quantity, CCMC numbers, and other appropriate technical indicators or references. The production and expiry date must also appear on the containers as requested by the Standard CAN/ULC-S705.1-98.

1.6 QUALITY ASSURANCE

- .1 Personnel licensed or approved by the Quality and Training Program – Raising Performance To New Heights by BASF and certified by Morrison Hershfield must apply the insulating material. These certified individuals must have their certification cards in their possession and available for presentation upon request. The certification cards must have the following: Level 1 (basic), Level 2 (Superior) or Foam Masters (Elite Level) for the polyurethane foam application.
- .2 A copy of the BASF Technical manual for the application of sprayed on polyurethane foam must be kept on site. In cases of transition membrane installation, a copy of the manufacturer's installation manual or guide is required.
- .3 Tests on the spray polyurethane must be conducted daily as per the Standard CAN/ULC-S705.2-98 and ensure results are in compliance. Enter the results in the daily report under the Quality and Training Program – Raising Performance To New Heights from BASF Canada and certified by Morrison Hershfield.
- .4 On request, submit a copy of all completed forms to the Contract Administrator prior to making application for payment.
- .5 Allow access to the job site to any BASF representative and/or Morrison Hershfield for the purpose of technical assistance, verification of operator certification or for a review under the Quality and Training Program – Raising Performance To New Heights as requested in the specification.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Apply insulating material only if the surface and ambient air temperatures are within the manufacturer's prescribed limits, i.e., -10°C to +40°C (+14°F to +104°F).
- .2 Comply with requirements regarding use, handling, storage and disposal of chemical materials; and regarding labelling and provision of material safety data sheets acceptable to Labour Canada.

1.8 SURFACE PREPARATION

- .1 Surfaces must be clean and dry, as required by CAN/ULC-S705.2-98. The substrate must be free of all frost, dust, oil, grease, oxidization, or any other element that may affect adhesion of the system i.e. high moisture content.
- .2 Metallic surfaces should be checked to ensure no oxidization has occurred. Use of a primer is strongly recommended. Refer to the BASF Technical manual.
- .3 All transition membranes must be installed prior to application of the polyurethane foam. Transition membranes must be as listed in BASF technical manual. Contact BASF if other membranes are to be utilized. These membranes must be installed in accordance with the manufacturer's recommendations. Adhesion of the membranes material to the substrate must be sufficient to resist the stress applied by the polyurethane foam during the curing time. Refer to the BASF Technical manual.
- .4 All of the following stages must be completed prior to application of the WALLTITE insulating foam:
 - .1 Installation of masonry anchoring system
 - .2 Installation of wood blocking required at all openings.
 - .3 Installation of any electrical or mechanical penetrations
 - .4 Air/vapour barrier transition membranes
 - .5 Sub-girt clip angles and sub-girt framing angle for exterior cladding
 - .6 Adjacent areas have been protected via drop sheets or polyethylene masking.

1.9 CONDITIONS OF USE

- .1 Follow the manufacturer's written instructions when spraying the polyurethane foam (refer to BASF's technical data sheet and the Technical manual, WALLTITE application guide section).
- .2 The manufacturer's recommendations should be followed with regard to outside air temperature and substrate conditions - 10°C to +40°C (+14°F to +104°F).

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Polyurethane Foam: a spray polyurethane foam listed under CAN/ULC-S705.1-98, with CCMC #12840-R for insulation and #12877-R for use as an air barrier material, according to CCMC technical guide: Air Barrier System for exterior walls of low-rise buildings, Master Format Section: 07272, with the following physical properties.
 - .1 Density (ASTM D-1622) minimum=30.4 kg/m³ (1.9 lb/ft.³)
 - .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.²
 - .9 Flame spread classification (CAN/ULC-S102, including S127) – 375
 - .10 Smoke determined – 288
 - .11 VOC results during the curing period were below the detectable limit after 24 hrs.
 - .12 Eco-efficiency analysis for the evaluation of the insulation / air barrier system
 - .13 Polyurethane durability test of appendix D of the CCMC Technical Guide for Air Barrier Systems for Exterior Walls of Low-Rise Buildings, that specifies the two following limiting criteria:
 - .1 Air permeance test after weathering and heat aging – Requirements: = 110% of original value;
 - .2 Thermal resistance after heat aging of weathered samples – Requirements: 90% retention from original value.
 - .14 Product reference: WALLTITE by BASF – The Chemical Company
- .2 Primers: as recommended in the BASF Technical Manual, taking into account the type and condition of work surfaces.
- .3 Horizontal fire stopping: A preformed angle comprising at least 1.2 mm (18 ga) of steel core zinc coating, as stipulated in ASTM A 525 (galvanized steel G-90). Dimensions should be sufficient to allow the horizontal section to extend beyond the outside polyurethane foam surface in order that a 50% compressed mineral fibre fire stop can be installed in the remaining space.
- .4 Vertical fire stopping: A preformed angle comprising at least 0.38 mm (28 ga) of steel core zinc coating, as stipulated in ASTM A 525 (galvanized steel G-90). Dimensions should be sufficient to allow the section perpendicular to the substrate to extend beyond the outside polyurethane foam surface for the full depth of the cavity in order to close off

the cavity. Sheet steel fire stop angles corners should be mechanically attached to the substrate at 200 mm (8 inches) OC.

- .5 Transition Membrane Self Adhering: SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, and having the following physical properties:
 - .1 Thickness: 1.0mm (40mils) min
 - .2 Air Leakage (ASTM E283-91): 0.0003 L/s.m.²@ 75Pa
 - .3 Vapour Permeance (ASTM E96): 1.6 ng/Pa.s.m.² (.03 Perms)
 - .4 Low Temperature Flexibility (CGSB 37-GP-%^M): -30°C
 - .5 Elongation (ASTM D412-modified): 40MPa
 - Acceptable material: Blueskin® SA as manufactured by Bakor or other material as acceptable by BASF. Refer to the BASF Technical manual.
- .6 Through-wall flashing membrane (Self-Adhering): SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, having the following physical properties:
 - .1 Thickness: 1.0mm (40mils) min
 - .2 Film Thickness: 0.225mm (9.0mils)
 - .3 Elongation: 200% to ASTM D412;
 - .4 Tensile Strength (film): 34500 kPa (5000 psi) to ASTM D882
 - .5 Vapour permeance: 1.6 ng/Pa.m².s (9.03 perms) to ASTM E96;
 - .6 Low temperature flexibility: -30°C to CGSB 37-GP-56M;
 - Acceptable material: Blueskin TWF as manufactured by Bakor
- .7 Through-wall flashing and damp proof coursing mastic: Synthetic asphalt/rubber base compound having the following characteristics:
 - .1 Compatible with air/vapour barrier membrane, substrate and insulation materials
 - Acceptable material: Polybitume® - 570-05 Rubberized Mastic as manufactured by Bakor.
- .8 Primer for self-adhering membranes: Synthetic rubber based adhesive type, quick setting, having the following physical properties:
 - .1 Colour: Blue
 - .2 Weight: ±0.8 kg/1
 - .3 Solids by weight: 35%
 - .4 Drying time (initial set): 30 minutes
 - Acceptable material: Blueskin Primer as manufactured by Bakor

PART 3 EXECUTION

3.1 WORKMANSHIP

- .1 All excessively wide joints should be covered or filled before applying the polyurethane foam.
- .2 Install transition membranes in all places recommended in section 3 of BASF's technical manual.
- .3 Install a bituminous polymer based caulking strip sealant i.e. BAKOR 570-05 at outside edge of the transition membrane installed horizontally on the concrete wall foundation.

Refer to section 3, drawings #TD 3B, 3D, and 4B, in BASF's technical product documentation.

- .4 At all openings, install a compressible foam pressure gasket and than Compressible foam pressure gasket, in all openings TREMCO Dy Monic sealant. Refer to section 3, drawings #TD 3B, 3D, and 4B, in BASF's technical product documentation.

3.2 PREPARATION

- .1 Polyurethane foam when used for insulation purpose, should be sprayed as per the Standard CAN/ULC-S705.2-98 with a tolerance of +6 / -0 mm (+1/4 / -0 inch) in relation to the specified thickness.
- .2 Avoid the formation of sub-layer air pockets when applying.
- .3 Avoid spraying the foam on any surfaces other than those indicated. Use drop sheets or masking tape to protect other surfaces.
- .4 Once the foam has hardened, remove all over spray from non-prescribed surfaces.
- .5 Do not allow polyurethane foam once applied, to be damaged during work by other trades.
- .6 Ensure the subsequent coverage of the applied insulating foam will be completed within the manufacturer's prescribed time frame (refer to BASF;s technical data sheet or Technical manual)

3.3 APPLICATION

- .1 Spray the polyurethane foam in overlapping layers, so as to obtain a smooth, uniform surface.
- .2 Do not spray polyurethane foam any closer than 75 mm (3") from chimneys, heating vents, steam pipes, recessed lighting fixtures and other heat sources. Do not spray the interior of any exit openings or electrical junction boxes (refer to BASF Technical manual).
- .3 In temperatures below +10°C (+50°F) use transition membranes specifically formulated for low temperature application with the proper primer. Adhesion tests must be conducted. Refer to the B ASF Technical manual. If no proper adhesion, then secure the membranes mechanically. Refer to the membrane's manufacturer.
- .4 All mechanical fixtures should be covered with polyurethane foam in order to reduce thermal bridging.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation methods providing air/vapour barrier materials and assemblies.
- .2 Air/vapour barrier materials to provide continuous seal between components of building envelope and building penetrations.

1.2 RELATED SECTIONS

- .1 Joint Sealers Section 07 92 00

1.3 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 Waterproofer’s Institute – Sealant and Caulking Guide Specification.
- .4 National Air Barrier Association (NABA).

1.4 QUALITY ASSURANCE

- .1 Perform work in accordance with Sealant and Waterproofer’s Institute – Sealant and Caulking Guide Specification requirements for materials and installation.
- .2 Perform work in accordance with National Air Barrier Association – Professional Contractor Quality Assurance Program and requirements for materials and installation.
- .3 Maintain one copy of documents on site.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturers written instructions.

1.6 PROJECT ENVIRONMENTAL REQUIREMENTS

- .1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.
- .2 Maintain temperature and humidity recommended by materials manufacturer before, during and after installation.

1.7 SEQUENCING

- .1 Sequence Work to permit installation of materials in conjunction with related materials and seals.

1.8 WARRANTY

- .1 Provide a 1-year warranty under provisions of Closeout Submittals.

- .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.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- .1 Type A: sloped roof peel and stick vapour barrier.
 - .1 Acceptable material: Ice and Water Shield- Grace, Sopraseal Stick 1100, Soprema 1.1 mm or approved equal in accordance with B6.
- .2 Type B: Eave protection.
 - .1 Acceptable material: Ice and Water Shield- Grace, Sopraseal Stick 1100, Soprema or approved equal in accordance with B6.
- .3 Type C: Thermo-fusible vapour barrier on concrete or masonry substrate.
 - .1 Acceptable material: Blueskin TG, Bakor, Sopraseal, Soprema or approved equal in accordance with B6.
- .4 Type D: Peel and stick vapour barrier for wood substrate or where open flame cannot be used.
 - .1 Acceptable material: Blueskin SA, Bakor, Lasto Bond, Soprema, Perma Barrier, Grace or approved equal in accordance with B6.
- .5 Type E: Basement/crawlspace areas.
 - .1 Acceptable material: 10 mil poly vapour barrier; (CAN CG SB 51.34-M86).
- .6 Type F: Exterior wall and roof surfaces as per drawings.
 - .1 Acceptable material: 6 mil poly vapour barrier, CMHC approved; (CANCG SB 51.34-M86).
- .7 Type G: Exterior wall surface sheet air barrier.
 - .1 Acceptable material: Tyvek, Dupont, Typar housewrap or approved equal in accordance with B6.
- .8 Type H: Roof under asphalt shingles.
 - .1 Acceptable material: 15 lb roofing felt (CAN CG SB 51.34-M86).
- .9 Type J: Flat roof vapour barrier.
 - .1 Acceptable material: Orange Label Fibrene, Permastop, Fibreglass Canada, or approved equal in accordance with B6.

2.2 SEALANTS

- .1 Sealants in accordance with Section 07 92 00 – Joint Sealers.

2.3 ADHESIVES

- .1 Mastic Adhesive: Compatible with sheet seal and substrate.
- .2 Acceptable material: Tremco Acoustical Sealant, or approved equal in accordance with B6.

2.4 ACCESSORIES

- .1 Thinner and cleaner for Butyl or Neoprene Sheet: as recommended by sheet material manufacturer. Non-staining type.
- .2 Joint Cleaner: Non-corrosive and non-staining type; recommended by sealant manufacturer; compatible with joint forming materials.
- .3 Tape: No. Y-8086, 3M, Contractor's Sheathing Tape, or approved equal in accordance with B6.

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, and continuous and comply with air barrier manufacturer's requirements.
- .3 Report any unsatisfactory conditions to the Contract Administrator in writing.
- .4 Do not start work until deficiencies have been corrected. Commencement of work implies acceptance of conditions.

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 self-adhesive 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 Install per drawings and details.
- .3 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 01 61 00 – Product Requirements.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure finished work is protected from climatic conditions.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Metal Flashing and Trim Section 07 62 00
- .2 Joint Sealers Section 07 92 00

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 36-95b, Specification for Gypsum Wallboard
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 37.5-M89, Cutback Asphalt Plastic Cement.
 - .2 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
 - .3 CGSB 37-GP-15M-76, Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
 - .4 CGSB 37-GP-19M-76, Cement, Plastic, Cutback Tar.
 - .5 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.
 - .6 CGSB 37-GP-56M-80, Membrane, Modified Bituminous, Prefabricated and Reinforced for Roofing.
 - .7 CAN/CGSB 51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .8 CAN/CGSB 51.26-M86, Thermal Insulation, Urethane and Isocyanurate Boards, Faced.
 - .9 CAN/CGSB 51.31-M84, Thermal Insulation, Mineral Fibre Board for Above Roof Decks.
 - .10 CAN/CGSB 51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for use in Building Construction.
 - .11 CAN/CGSB 51.34-M86, Vapour Barrier Sheet, Polyethylene Sheet, for use in Building Construction.
 - .12 CAN/CGSB 51.38-92, Cellular Glass Thermal Insulation.
- .3 Canadian Standards Association (CSA)
 - .1 CSA A123.3-M1992, Asphalt or Tar Saturated Roofing Felt.
 - .2 CSA A123.4-M1992, Bitumen for Use in Construction of Built-up Roof Coverings and Dampproofing and Waterproofing Systems.
 - .3 CAN/CSA-A247-M86, Insulating Fibreboard.
 - .4 CSA A284-1976, Mineral Aggregate Thermal Roof Insulation.
 - .5 CSA O121-M1978, Douglas Fir Plywood.
 - .6 CSA O151-M1978, Canadian Softwood Plywood.

1.3 STORAGE AND HANDLING

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

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install roofing when temperature remains below -18°C for torch application, or -10°C or manufacturers' recommendations for mop application.
- .2 Minimum temperature for solvent-based adhesive is -5°C.
- .3 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.5 PROTECTION

- .1 Fire Extinguishers: maintain one cartridge-operated type with hose and shut-off nozzle, ULC labelled for A, B and C class protection. Size 9 kg on roof per torch applicator, within 10 m of torch applicator.
- .2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.6 WARRANTY

- .1 For the Work of this Section 07 52 11- Modified Bituminous Roofing, the 12 months warranty period prescribed in subsection GC 13.2 of General Conditions "C" is extended to 60 months. Material warranty is 10 years non-prorated.

1.7 COMPATIBILITY

- .1 Compatibility between components of roofing system is essential. Provide written declaration to Contract Administrator stating that materials and components, as assembled in system, meet this requirement.

1.8 QUALITY ASSURANCE

- .1 Submit laboratory test reports in accordance with Section 01 45 00- Quality Control.
- .2 Installers to be CRCA member or RCAM member (in Manitoba) with 5 years minimum experience.

PART 2 PRODUCTS

2.1 MEMBRANE

- .1 Base Sheet: to CGSB 37-GP-56M, Styrene-Butadiene-Styrene (SBS) Elastomeric polymer thermoplastic polymer, prefabricated sheet, polyester reinforcement, weighing 180 g/m².
 - .1 Type 1, fully adhered.
 - .2 Type 2, fully adhered, loose laid.
 - .3 Class A-C plain surfaced.

- .4 Grade 1- heavy-duty service.
- .5 Top and bottom surfaces:
 - .1 Polyethylene/polyethylene.
- .6 Acceptable material: Soprabase ½ FR board with laminated base sheet or approved equal in accordance with B6.
- .2 Cap sheet: to CGSB 37- GP-56M, Styrene-Butadiene-Styrene (SBS) Elastomeric polymer thermoplastic polymer, prefabricated sheet, polyester reinforcement, weighing 250 g/m2.
 - .1 Type 1, fully adhered.
 - .2 Class A- granule surfaced.
 - .3 Grade heavy-duty surface.
 - .4 Bottom surface polyethylene.
 - .5 Acceptable material: Sopralene Flam 250 or approved equal in accordance with B6, granulated, colour from standard range (non-metallic) colours.
- 2.2 INSULATING FIBREBOARD
 - .1 To CAN/CSA-A247, Type 1 roof board, surface coated, 6.4 mm thick.
 - .1 Acceptable material: Soprabase or approved equal in accordance with B6.
- 2.3 MEMBRANE FLASHING
 - .1 Acceptable material: Soprabase or approved equal in accordance with B6.
- 2.4 SEALERS
 - .1 Plastic cement: asphalt, SBS to CAN/CGSB-37.5, to CGSB 37-GP-19M.
 - .1 Acceptable material: Sopramastic, or approved equal in accordance with B6.
 - .2 Sealing compound: to CAN/CGSB- 37.29, rubber asphalt type.
 - .1 Acceptable material: Sopramastic, or approved equal in accordance with B6.
 - .3 Sealants: Sopramastic, or approved equal in accordance with B6.
- 2.5 FASTENERS
 - .1 Insulation to deck: fasteners and 50mm plates minimum must meet Factory Mutual 4470 Standard for wind uplift and corrosion resistance.
- PART 3 EXECUTION**
- 3.1 WORKMANSHIP
 - .1 Do roofing Work in accordance with applicable standard in Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual.
 - .2 Do priming for asphalt roofing in accordance with CGSB 37-GP-15M.
- 3.2 PROTECTION
 - .1 Cover walls and adjacent Work where materials hoisted or used.
 - .2 Use warning signs and barriers. Maintain in good order until completion of Work.
 - .3 Clean off drips and smears of bituminous material immediately.

- .4 Dispose of rainwater off roof and away from face of building until roof drains or hoppers are installed and connected.
 - .5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Contract Administrator.
 - .6 At end of each day's Work or when stoppage occurs due to inclement weather, provide protection for completed Work and material out of storage.
- 3.3 EXAMINATION OF ROOF DECKS
- .1 Examine roof decks and immediately inform Contract Administrator in writing of defects.
 - .2 Inform Contract Administrator 24 hours prior to beginning Work.
 - .3 Prior to commencement of Work, ensure:
 - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris.
 - .2 Curbs have been built.
 - .3 Roof drains have been installed at proper elevations relative to finished roof surface.
 - .4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.
- 3.4 EXPOSED MEMBRANE ROOFING APPLICATION
- .1 Base sheet application.
 - .1 Fasten boards mechanically in conformance with illustrations in Specifications Manual.
 - .2 All panels must be in perfect condition, without any significant differences in level, and must be adhered on all their surfaces completely.
 - .3 Complete side joints sealing by torching seal and overlaps in a similar fashion.
 - .4 All vertical joints between substrate and boards will be staggered vertically and horizontally.
 - .2 Cap sheet application
 - .1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and re-roll from both ends.
 - .2 Unroll and embed cap sheet in uniform coating of asphalt applied at rate of 1.2 kg/m², EVT at point of contact.
 - .3 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.
 - .4 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet.
 - .5 Application to be free of blisters, fishmouths, and wrinkles
 - .6 Do membrane application in accordance with manufacturers recommendations.
 - .3 Flashings
 - .1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.

- .2 Torch cap sheet onto substrate in 1 metre wide strips.
- .3 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal by torch welding.
- .4 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.
- .5 Provide 75 mm minimum side lap and seal.
- .6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.
- .7 Do Work in accordance with manufacturers recommendations.

PART 1 GENERAL

1.1 WORK INCLUDED

- .1 The Work included under this section shall conform to the industry standard and be accepted by the local construction and trade associations.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- .1 Pre-coated Galvanized Steel: ASTM A525, Z275 zinc coating; 0.6 mm (24 ga.) core steel in all installed locations higher than 2 meters, 1.23 mm (18 ga.) core steel in all installed locations at or lower than 2 meters, shop pre-coated galvalume.
- .2 Galvalume sheet steel: commercial quality to ASTM A 653 with Z275 designation zinc coating, 24 ga. thickness.
- .3 Fascia: Pre-coated Galvalume Steel: ASTM A525, Z275 zinc coating; 0.6 mm (24 ga.) core steel in all installed shop pre-galvanized.

2.2 ACCESSORIES

- .1 Fastener: Galvanized steel with fibreglass reinforced nylon head and soft neoprene washer at exposed locations. Finish exposed fasteners same as flashing metal.
- .2 Sealant: Silicone; colour-grey where not exposed to site and to match adjacent materials where exposed.
- .3 Tape: isobutyl, colour grey-3x25.
- .4 Fasteners: same material as sheet metal to CSA B111, flat head roofing nails.
- .5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .6 Isolation coating: to CAN/CGSB-1.108.
- .7 Isolate dissimilar metals from reacting.

2.3 FABRICATION

- .1 Form sections true to shape, accurate in size, square, and free from distortion or defects.
- .2 Fabricate cleats, clips, and starter strips of same material as sheet, inter-lockable with sheet.
- .3 Form pieces in longest practical lengths.
- .4 Hem exposed edges on underside 13 mm; miter and seam corners.
- .5 Form material with flat lock seam.
- .6 Seal all joints with silicone.
- .7 Fabricate corners from one piece with minimum 450 mm long legs; solder for rigidity, seal with silicone sealant.
- .8 Fabricate vertical faces with bottom edge formed outward 6 mm and hemmed to form drip.
- .9 On exposed faces, return drip edge hem back to form interlock with concealed clip. Provide continuous clips at all exposed faces.
- .10 Fabricate flashings to allow toe to extend 50 mm over roofing. Return and brake edges.

PART 3 EXECUTION

3.1 INSPECTION

- .1 Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- .2 Verify membrane termination and base flashings are in place, sealed and secure.
- .3 Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- .1 Field measure site conditions prior to fabricating Work.
- .2 Install starter and edge strips, and cleats before starting installation.

3.3 INSTALLATION

- .1 Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- .2 Secure flashings in place using concealed continuous clip fasteners at all visible flashings. Use exposed fasteners only in locations not ordinarily visible (e.g. – inside parapet walls). All exposed fasteners must be on vertical surfaces.
- .3 Apply plastic cement compound between metal flashings and felt flashings.
- .4 Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- .5 Seal metal joints watertight.
- .6 Clean any drippage and spills of surplus sealant or plastic cement from adjacent surfaces and make good any damage caused by the Work.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Division 15 and 16 respectively.

1.2 REFERENCES

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

1.3 SAMPLES

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

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00- 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.

1.5 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00- 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.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases on compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended.
 - .2 Firestop system rating: 1½ hour.
- .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 thickness 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 and 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 un-penetrated 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 Contract Administrator 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 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .4 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .5 Openings and sleeves installed for future use through fire separations.
 - .6 Around mechanical and electrical assemblies penetrating fire separations.

- .7 Rigid ducts: greater than 129 cm²: 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.

PART 1 GENERAL

1.1 REFERENCES

- .1 CAN/CGSB-19.1-M87, Putty, Linseed Oil Type.
- .2 CAN/CGSB-19.2-M87, Glazing Compound, Non-hardening, Modified Oil Type.
- .3 CGSB-19-GP-5M-76, Sealing Compound, One Component, Acrylic Base.
- .4 CAN/CGSB-19.6-M87, Caulking Compound, Oil Base.
- .5 CAN/CGSB-19.3-M87, Sealing Compound, One Component, Elasmometric Chemical Curing.
- .6 CAN/CGSB-19-GP-14M-76, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .7 CAN/CGSB-19.17-M90, One Component Acrylic Emulsion Base Sealing Compound.
- .8 CAN/CGSB-19.18-M87, Sealing Compound, One Component, Silicone Base, Solvent Curing.
- .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.

1.2 SAMPLES

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

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, Handle, store and protect materials in accordance with Section 01 61 00 – 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.

1.4 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 Work areas as directed by Contract Administrator by use of approved portable supply and exhaust fans.

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.

- .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, bylaws 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 (VOC) in excess of 5% by weight as calculated from records of the amounts of constituents used to make the product.
- .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 off-gas 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: non-flammable, low Volatile Organic Compound (VOC) content, manufactured without compounds which contribute to ozone depletion in the upper atmosphere, does not contain methylene chloride, does not contain chlorinated hydrocarbons.
- .8 Sealants acceptable for use on this project except CAN/CGSB-19.1 and CAN/CGSB-19.18 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 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore hardness 70.
- .2 High Density Foam
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
- .3 Bond Breaker Tape
 - .1 Polyethylene bond breaker tape, which will not bond to sealant.
- .4 Polyurethane Sealant
 - .1 CAN 19.13-M87; single component, high performance, non-sagging, low modulus, non-staining and non-bleeding. To be used at all exterior and interior control/expansion joints and on the exterior side of all window/door frames perimeters. Colour as selected by the Contract Administrator. Standard of acceptance: Tremco Dymonic or approved equal in accordance with B6.
- .5 Latex Sealant
 - .1 CGSB19GP-17M; single component, non-sagging, non-bleeding, moisture curing. To be used on the interior side of all exterior window/door frame

perimeters and at all interior window/door frame perimeters. Colour as selected by the Contract Administrator. Standard of acceptance: Tremco 200 latex or approved equal in accordance with B6.

.6 Silicone Sealant

- .1 CGSB 19-GP-9M; single component, fungus resistant, non-sagging, non-staining, non-bleeding, moisture curing. To be used in all sloped glazing, skylights, and at all joints between vanities, countertops, backsplashes, and adjacent wall materials and at the joint between bathtubs and finish flooring in washrooms. Colour as selected by the Contract Administrator. Standard of acceptance: Tremco Proglaze or approved equal in accordance with B6.

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.

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.

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- .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, and 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 Clean Up
- .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.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Door Hardware Section 08 71 00
- .2 Joint Sealers: Caulking of joints between frames and other building components.
Section 07 92 00
- .3 Door Hardware: Supply of finish hardware, including weather stripping and mounting heights
Section 08 71 00
- .4 Glazing: Glazing Section 08 80 50
- .5 Painting Section 09 91 10

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A 653M-95, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
 - .2 ASTM B 29-(92), Specification for Pig Lead.
 - .3 ASTM B 749-85(1991), Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.181-92, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
 - .3 CAN/CGSB-51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .4 CGSB 51-GP-21M-78, Thermal Insulation, Urethane and Isocyanurate, Unfaced.
- .3 Canadian Standards Association (CSA).
 - .1 CSA A101-M1983, Thermal Insulation, Mineral Fibre, for Buildings.
 - .2 CAN/CSA-G40.21-M92, Structural Quality Steels.
 - .3 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door and Frame Manufacturer's Association, (CSDFMA).
 - .1 CSDFMA, Specifications for Commercial Steel Doors and Frames, 1990.
 - .2 CSDFMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990.
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA 80-1992, Fire Doors and Windows.
 - .2 NAPA 252-1990, Door Assemblies, Fire Tests of.
- .6 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN-S104M-M80(R1985), Fire Tests of Door Assemblies.
 - .2 CAN-S105M-M85, Fire Door Frames.

1.3 DESIGN REQUIREMENTS

- .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kpa not to exceed 1/175th of span.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvered, arrangement of hardware and fire rating and finishes.
- .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, fire-rating, finishes.
- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .5 Submit test and engineering data, and installation instructions.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M for ratings specified or indicated.
- .2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN4-S104, ASTM E 152 or NFPA 252 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.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A 653M, minimum base steel thickness in accordance with CSDFMA Table 1 – Thickness for Component Parts.
- .2 Reinforcement channel: to CAN/CSA-G40.21, Type 44W, coating designation to ASTM A 653M.
- .3 Cast or rolled pure sheet lead: to ASTM B 29, weight: 14.6 kg/m², thickness 1.2 mm.
- .4 Composites: balance of core materials used in conjunction with lead: in accordance with manufacturers' proprietary design.

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/m³ minimum sanded to required thickness.
- .2 Stiffened: face sheets welded, insulated core.
 - .1 Fibreglass: to CSA A101, semi-rigid RSI 2.3
 - .2 Polyurethane: to CGSB 51-GP-21M rigid, modified polyisocyanurate, closed cell board. Density 32 kg/m³.

- .3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250°C at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E 152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency have factory inspection service.
- .4 Thermal insulation material must:
 - .1 Not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act;
 - .2 Be manufactured using a process that uses chemical compounds with the minimum ozone depletion potential (ODP) available.
- 2.3 ADHESIVES
 - .1 Select Adhesives which:
 - .1 Do not contain volatile organic compounds in excess of 5% by weight as measured by EPA Method 24-24A, 40 C.F.R., Part 60, Appendix A (1991), as demonstrated through calculation from records of the amounts of constituents used to make the product;
 - .2 Are accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance;
 - .3 Are accompanied by information describing proper disposal methods for containers.
 - .2 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
 - .3 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
 - .4 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.
- 2.4 PRIMERS
 - .1 Touch-up prime CAN/CGSB-1.181.
- 2.5 PAINT
 - .1 Steel doors and frames shall be field painted in accordance with Section 09 91 10. Weatherstripping shall be protected from paint. Finish shall be free of scratches or other blemishes.
 - .2 Paint: water based, manufactured without compounds which contribute to ozone depletion in the upper atmosphere, does not contain toxic metal pigments.
- 2.6 ACCESSORIES
 - .1 Door silencers: single stud rubber/neoprene type.
 - .2 Exterior top and bottom caps: steel.
 - .3 Interior top and bottom caps: steel.
 - .4 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.

- .5 Metallic paste filler: to manufacturer's standard.
 - .6 Fire labels: metal riveted.
 - .7 Glazing: as per Section 08 80 50.
 - .8 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable stainless steel glazing beads for dry glazing of snap-on type.
 - .2 Design exterior glazing stops to be tamperproof.
- 2.7 FRAMES FABRICATION GENERAL
- .1 Fabricate frames in accordance with CSDFMA specifications.
 - .2 Fabricate frames to profiles and maximum face sizes as indicated.
 - .3 Exterior frames: 14 gauge minimum thermally broken type construction.
 - .4 Interior frames: 14 gauge minimum welded type construction.
 - .5 Blank, reinforce, drill and tap frames for mortised, template hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
 - .6 Protect mortised cutouts with steel guard boxes.
 - .7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
 - .8 Manufacturer's nameplates on frames and screens are not permitted.
 - .9 Conceal fastenings except where exposed fastenings are indicated.
 - .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
 - .11 Insulation 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.
 - .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm o.c. maximum.
- 2.9 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.
 - .7 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.
- 2.10 DOOR FABRICATION GENERAL
- .1 Doors: swing type, flush, with provision for glass and/or louver openings as indicated.
 - .2 Exterior doors: honeycomb construction. Interior doors: honeycomb construction.
 - .3 Fabricate doors to tack and fill edges at perimeter every 150mm. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
 - .4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E 330.
 - .5 Blank, reinforce, drill doors and tap for mortised, template hardware and electronic hardware.
 - .6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
 - .7 Reinforce doors where required, for surface mounted hardware. Provide flush PVC top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
 - .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
 - .9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104, ASTM E 152 or NFPA 252 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.
 - .10 Manufacturer's nameplates on doors are not permitted.
- 2.11 DOORS: HONEYCOMB CORE CONSTRUCTION
- .1 Form each face sheet for exterior doors from 16 gauge sheet steel with polyurethane core laminated under pressure to face sheets.
 - .2 Form each fact sheet for interior doors from 16 gauge sheet steel with temperature rise rated core laminated under pressure to face sheets.
- 2.12 HOLLOW STEEL CONSTRUCTION
- .1 Form each face sheet for exterior doors from 16 gauge minimum sheet steel.
 - .2 Form each face sheet for interior doors from 16 gauge minimum 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.
 - .5 Fill voids between stiffeners of interior doors with temperature rise rated core.

2.13 THERMALLY BROKEN DOORS AND FRAMES

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

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 CSDFMA 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 Vapour Retarder.

3.3 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 – Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latch side and head: 1.5 mm.
 - .3 Finished floor, top of carpet, non-combustible sill, and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.

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 08 80 50 – Glazing.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Finish Carpentry Section 06 20 00
- .2 Door Hardware Section 08 71 00
- .3 Glazing Section 08 80 50
- .4 Painting Section 09 91 10

1.2 REFERENCES

- .1 CSA 0115-M1982 Hardwood and Decorative Plywood
- .2 CAN/CSA 0132.2 Series-90 Wood Flush Doors
- .3 CAN/CGSB-71.19-M88 Adhesive, Contact, Sprayable
- .4 CAN/CGSB-71.20-M88 Adhesive, Contact, Brushable

1.3 REFERENCE STANDARDS

- .1 Do architectural woodwork for doors to Millwork Standards of the Architectural Woodwork Manufacturers Association (AWMAC) 2003, except where specified otherwise.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittals.
- .2 Indicate door types and cut-outs for lights and louvers.

1.5 REGULATORY REQUIREMENTS

- .1 Fire-resistance rated for wood doors: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.6 PROTECTION

- .1 Protect doors from dampness. Arrange delivery of doors after any Work causing abnormal humidity has been completed.
- .2 Store doors in a well ventilated room, off the floor, in accordance with manufacturer's recommendations.
- .3 Protect doors from scratches, handling marks and other damage.

PART 2 PRODUCTS

2.1 WOOD FLUSH DOORS

- .1 Solid core: to CAN/CSA -0132.21.
 - .1 Construction: Particleboard core, wood chips bonded with synthetic resin, complete with stiles and rails bonded to core and sanded prior to application of faces. (to be used for interior use only)
 - .2 Face Panels: Paint Grade birch, Rift Cut, uniform white face: confirm veneer to be used with Contract Administrator by providing sample for approval.
 - .3 Adhesive: Type 1 (Waterproof). Lockweld Adhesives Systems Are Not Acceptable.

2.2 FABRICATION

- .1 Vertical edge strips to match face veneer.
- .2 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side
- .3 Top and bottom of doors to be sealed.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install doors and hardware in accordance with manufacturer's printed instructions.
- .2 Adjust hardware for correct function.

3.2 ADJUSTMENT

- .1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Door Hardware Section 08 71 00
- .2 Joints Sealers Section 07 92 00
- .3 Division 26 - Electrical

1.2 REFERENCES

- .1 Aluminum Association Designation System for Aluminum Finishes-1997.
- .2 American Society for Testing and Materials (ASTM).
 - .1 ASTM E 330-97, Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- .3 Canadian General Standards Board (CGSB).
 - .1 CGSB 1.40-M89, Primer, Structural Steel, Oil Alkyd Type.
- .4 Canadian Standards Association (CSA).
 - .1 CAN/CSA-G40.21-98, Structural Quality Steels.
 - .2 CSA G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 DESIGN CRITERIA

- .1 Design frames and doors in exterior walls to:
 - .1 Accommodate expansion and contraction within service temperature range of – 35 to 35°C.
 - .2 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E 330 under wind load of 1.2 kpa.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate each type of door and frame, extrusion profiles, method of assembly, section and hardware reinforcement, locations of exposed fasteners, finishes and location of manufacturer's nameplates.
- .3 Submit catalogue details for each type of door and frame illustrating profiles, dimensions and methods of assembly.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for cleaning and maintenance of Aluminum finishes.

1.6 PROTECTION

- .1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.
- .2 Leave protective covering in place until final cleaning of building.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Aluminum extrusions: Aluminum Association alloy AA6063-T6 anodizing quality.

- .2 Steel reinforcement: to CAN/CSA-G40.21, grade 300 W.
 - .3 Fasteners: stainless steel, finished to match adjacent material.
 - .4 Weatherstrip: mohair pile.
 - .5 Door bumpers: black neoprene.
 - .6 Isolation coating: alkali resistant.
 - .7 Glass: Factory sealed double glazing unit; 25 mm overall thickness, comprised of laminated film 0.030 inches thick, clear, glass each side of air space to CAN/CGSB-12.8-M.
 - .8 Sealants: to CAN/CGSB 19.13-M87.
 - .9 Door panel: 1" O.D. size comp. Panel. Exterior faces to match Aluminum finish.
- 2.2 ALUMINUM DOORS
- .1 Acceptable material: Alumicor insuldoor series 400A Exterior entrances. Alumicor 3400 series exterior entrance framing.
 - .1 Glazing stops: tamperproof type.
 - .2 Hardware: see Door and Hardware Schedule, Section 08 71 00.
- 2.3 ALUMINUM FRAMES
- .1 Construct insulated frames of Aluminum extrusions with minimum wall thickness of 3 mm.
 - .2 Frame members 114 x 44.5 mm nominal size not thermally broken, for flush glazing.
- 2.4 ALUMINUM FINISHES
- .1 Finish exposed surfaces of Aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Standard Bronze anodized finish.
 - .2 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative.
- 2.5 STEEL FINISHES
- .1 Finish steel clips and reinforcing steel with zinc coating to CSA G164.
- 2.6 FABRICATION
- .1 Doors and frames to be by same manufacturer.
 - .2 Fabricate doors and frames to profiles and maximum face sizes as shown. Provide minimum 22 mm bite for insulating glazed units.
 - .3 Provide structural steel reinforcement as required.
 - .4 Fit joints tightly and secure mechanically.
 - .5 Conceal fastenings.
 - .6 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08 71 00 – Door Hardware.
 - .7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Set frames plumb, square, level at correct elevation in alignment with adjacent Work.
- .2 Anchor securely.
- .3 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- .4 Adjust operable parts for correct function.
- .5 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

3.2 GLAZING

- .1 Glaze Aluminum doors and frames in accordance with Section 08 80 50 – Glazing.

3.3 CAULKING

- .1 Seal joints to provide weathertight seal at outside and air, vapour seal at inside.
- .2 Apply sealant in accordance with Section 07 92 00 – Joint Sealers. Conceal sealant within the aluminum Work except where exposed use is permitted by Contract Administrator.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Glazing Section 08 80 50

1.2 WORK INCLUDED

- .1 The Work included under this section shall conform to the definitions in the “Manitoba Trade Definitions” handbook produced by the Winnipeg Construction Association.

1.3 REFERENCES

- .1 CAN3-A440-M84 – Omnibus Window Standard and CAN 3-A44-M90.

1.4 PERFORMANCE

- .1 Window components to provide for expansion and contraction caused by a cycling temperature range of 100 degrees C without causing detrimental effects to components. Limit mullion deflection to 1/200, or flexure limit of glass with full recovery of glazing materials, whichever is less.

- .2 Classification rating to CAN 3-A44-M90

	<u>Air</u>	<u>Water</u>	<u>Wind</u>
Awning	A3	B7	C4
Casement	A3	B6	C3
Fixed		B7	C4
Single Hung	A3	B7	C5

- .3 There shall be no uncontrolled water penetration under designed loads. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system , to exterior.

1.5 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data to requirements of Section 01 33 00 Submittal Procedures.
- .2 Indicate on shop drawings wall opening and component dimensions; wall opening tolerances required; anchorage and fasteners; affected related Work; installation requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver products to site, and store and protect products on site, to requirements Section 01 61 00 – Product Requirements.
- .2 Accept products of this section on site in new condition and verify no damage.

1.7 WARRANTY

- .1 Provide a TWENTY (20) year Warranty for all fibreglass frame and sash components. Warranty to cover window system for failure to meet specified requirements. Warranty applies to product only with labour not included.
- .2 Provide a TEN (10) year Warranty for the failure of the air seal due to defects in the material or workmanship. Warranty applies to product only with labour not included.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 All frame and sash profiles are made from Pultruded Fiberglass, having a minimum of wall thickness of 0.090" (2.3 mm), with minimum glass content of 60%. Non-structural accessory members are permitted to be in vinyl or aluminum and are identified as such.
- .2 Fasteners: Non magnetic, stain and corrosion resistant stainless steel to ASTM E-149.
- .3 Insect Screen: to CGSB 79-GP-1M and CAN3-A440-M84 Heavy Duty Classification with 18 x 14 aluminum mesh in baked enamel aluminum frame – colour to match window frame.
- .4 Sill and Flashings: aluminum to match window framing.

2.2 WEATHER-STRIPPING

- .1 Q-Lon air-seal gasket on interior with Santoprene bulb-type "rain screen" gasket on the exterior to provide weather barrier. Dust seal to be flexible PVC. Secondary seal to be dual Durometer Santoprene.

2.3 WINDOWS

- .1 Standard of acceptance:
 - .1 Duxton Windows Ltd. (Inline Fibreglass Ltd.): Sovereign series 325, narrow brick mould, low profile typical.
 - .2 Accurate Dorwin Ltd. Windows (OmniGlass Ltd.): Awning series or approved equal in accordance with B6.

2.4 HARDWARE

- .1 Concealed Stainless Steel Hinges, E-Gard Roto Gear Operators and metal Cam are manufactured by "TRUTH Hardware" or approved equal in accordance with B6. Hardware is installed with fasteners into patented back-up reinforcements.
- .2 All operable windows to have restricted operation, so that no object larger than a 4" diameter sphere may pass through.

2.5 GLASS

- .1 All windows are glazed as specified in Section 08 80 50. Glass thickness shall be in accordance with applicable Building Code.

2.6 GLAZING METHOD

- .1 Laid-in glazing using EPDM non-shrink rubberized glass stop locked-in from the interior provides a secure and positive seal for the glass and easier after install glass servicing.

2.7 INSECT SCREEN

- .1 Roll-formed aluminum frame with friction fit corner keys. Screen mesh held in place by spline. Screens are mounted on the interior and are removable.

2.8 FABRICATION

- .1 Frame and sash corners are connected with moulded reinforced polyester shearblocks and mechanically secured. All joints are factory sealed and neatly fitted together. The perimeter of open-back frames shall be filled with insulation. Fabricate windows allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling

installation. Make corner joints flush, hairline, and weatherproof. Seal corner joints with sealant. Develop drainage holes with moisture pattern to exterior.

2.9 FINISHES

.1 The exposed surfaces to have 10 year warranty against fading, peeling or cracking are:

.1 Isocyanate-free 2 part Polymer Enamel with a minimum dry film thickness of 1.5 mils with a medium gloss of 25-55. Finish shall resist chipping, blistering, chalking discoloration and aging under all atmospheric conditions. Conforms to AAMA 603 and 613 Organic Coatings.

.2 Concealed Steel Items: Galvanized in accordance with CSA G164M.

.3 Colours: Standard colour (Commercial Brown)

PART 3 Execution

3.1 INSPECTION

.1 Verify that surfaces are ready to receive Work and opening dimensions are as indicated on shop drawings.

.2 Verify wall openings and adjoining air and vapour seal materials are ready to receive Work of this Section.

.3 Beginning of installation means acceptance of substrate.

3.2 INSTALLATION

.1 Installation shall be performed by experienced installers in accordance with manufacturer instructions and CSA A-440.4 Standards. Window shall be plumb and square after installation is complete and sealed to both interior and exterior wall with a high quality sealant around the perimeter of the frame. If perimeter cavity is to be foamed, additional anchorage may be required to prevent bowing. It shall be the responsibility of the installers to make all necessary final adjustments to ensure normal and smooth operation.

.2 Align window frame plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent Work.

.3 Coordinate attachment and seal of air and vapour barrier materials.

.4 Pack fibrous insulation in shim spaces at perimeter to maintain continuity of thermal barrier.

.5 Install glass in accordance with Section 08 80 50.

.6 Install perimeter type sealant, backing materials, and installation requirements in accordance with Section 07 92 00. Apply sealant to ends of sill for watertight seal.

3.3 MAINTENANCE

.1 Occasional wash of glass and frame components with non-abrasive detergent is recommended.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Finish Carpentry Section 06 20 00
- .2 Steel Doors and Frames Section 08 12 13
- .3 Aluminum Doors and Frames Section 08 41 13
- .4 Division 26 - Electrical

1.2 REFERENCES

- .1 Standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturer's Association.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-69.17-M86, Bored and Pre-assembled 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-69.24-M90 / ANSI/BHMA A156.8-1982, Door Controls- Overhead Holders.
 - .7 CAN/CGSB-69.26-96 / ANSI/BHMA A156.10-1985, Power Operated Pedestrian Doors.
 - .8 CAN/CGSB-69.29-93 / ANSI/BHMA A156.13-1980, Mortise Locks and Latches.
 - .9 CAN/CGSB-69.30-93 / ANSI/BHMA A156.14-1985, Sliding and Folding Door Hardware.
 - .10 CAN/CGSB-69.31-M89 / ANSI/BHMA A156.15-1981, Closer/Holder Release Device.
 - .11 CAN/CGSB-69.32-M90 / ANSI/BHMA A156.16-1981, Auxiliary Hardware.
 - .12 CAN/CGSB-69.33-M90 / ANSI/BHMA A156.17-1987, Self-Closing Hinges and Pivots.
 - .13 CAN/CGSB-69.34-93 / ANSI/BHMA A156.18-1984, Materials and Finishes.
 - .14 CAN/CGSB-69.35-M89 / ANSI/BHMA A156.19-1984, Power Assist and Low Energy Power Operated Doors.
 - .15 CAN/CGSB-69.36-M90 / ANSI/BHMA A156.20-1984,

1.3 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.

1.4 HARDWARE LIST

- .1 Submit Contract hardware list in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

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 01 78 10 - Closeout Submittals.
- .2 Instruct maintenance staff regarding proper care, cleaning and general maintenance on door hardware.

1.6 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 10 - Closeout Submittals.
- .2 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

1.7 DELIVERY AND STORAGE

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

PART 2 PRODUCTS

2.1 HARDWARE ITEMS

- .1 Only door locksets and latch sets listed on CGSB Qualified Products List are acceptable for use on this project.
- .2 Use One Manufacturer's Products For All Similar Items.

2.2 DOOR HARDWARE

- .1 Locks and Latches:
 - .1 Bored and pre-assembled locks and latches to: CAN/CGSB-69.17, as stated in Hardware Schedule.
 - .2 Lever handles: plain design.
 - .3 Normal strikes: box type, lip projection not beyond jamb.
 - .4 Cylinders: key into keying system as instructed by the Contract Administrator.
 - .5 Finished: as specified in Hardware Schedule.
- .2 Butts and Hinges:
 - .1 Butts and hinges to: CAN/CGSB-69.20, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
- .3 Exit Devices to: CAN/CGSB-69.19, type modern design.

- .4 Door Closers and Accessories
 - .1 Door controls (closers): to CAN/CGSB-69.20.
- .5 Door Operators:
 - .1 Power-operated pedestrian doors to CAN/CGSB-69.26.
 - .2 Power assist and low energy power operated doors to: CAN/CGSB-69.35.
- .6 Smoke Seal:
 - .1 Neoprene bulb, fire resistant, adhesive backed, set in doorframe rabbet.
- 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 of 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.
- 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 manufacturer's 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 Manufacturer's Association.
 - .4 Where Doorstop Contacts Door Pulls, Mount Stop To Strike Bottom Of Pull.
- 3.2 MOUNTING HEIGHTS
 - .1 Maintain the following mounting heights above finished floor for door from finished floor to centre line of hardware item:
 - .1 Locksets 900
 - .2 Push/Pulls 1050
 - .3 Deadlocks 1070
 - .4 Panic Devices 900
 - .5 Auto Openers 900
- 3.3 SET-UP KEYING SYSTEM
 - .1 Turn over keys to Contract Administrator.

PART 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASTM E 330-97e1, Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 542-94, Specification for Lock-Strip Gaskets.
 - .2 ASTM E 84-99, Test Method for Surface Burning Characteristics of Building Materials.
 - .3 ASTM F 1233-98, Test Method for Security Glazing Materials and Systems.
- .3 Canadian Door and Window Manufacturers Certification Program.
- .4 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.
 - .3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
 - .4 CAN/CGSB-12.8-97, Insulating Glass Units.
 - .5 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
 - .6 CAN/CGSB-12.11-M90, Wired Safety Glass.
- .5 Canadian Standards Association (CSA)
 - .1 CSA A440.2-98, Energy Performance Evaluation of Windows and Sliding Glass Doors.
- .6 Environmental Choice Program (ECP)
 - .1 ECP-45-92, Sealants and Caulking.
- .7 Flat Glass Manufacturers Association (FGMA) Glazing Manual.

1.2 PERFORMANCE REQUIREMENTS

- .1 Provide continuity of building enclosure vapour air barrier using glass and glazing materials as follows:
 - .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 as measured in accordance with ANSI/ASTM E 330.
 - .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 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.

- 1.5 QUALITY ASSURANCE
 - .1 Perform Work in accordance with FGMA Glazing Manual for glazing installation methods.
 - .2 Provide testing of glass under provisions of Section 01 45 00 - Quality Control.
- 1.6 ENVIRONMENTAL REQUIREMENTS
 - .1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
- PART 2 PRODUCTS**
- 2.1 MATERIALS
 - .1 Type A: Float Glass for interior units: CAN2-12.3M; glazing quality, thickness to suit opening size and thickness and shall be in accordance with applicable Building Code, clear.
 - .2 Type D: Insulated Glass Units at entrances: CAN2-12.8M; double pane, outer pane of Type B safety Glass, inner pane of Type B safety glass, thickness to suit opening size and thickness shall be in accordance with applicable Building Code. Inter-pane space of a full 13 mm, purged dry and hermetically sealed, (22 mm) insulating glass units with Argon and Super Spacer with R-value of 4.2 (cog) and SHGC of .52.
 - .3 Type E: Insulated Glass Units for all exterior south and west facing windows: CAN2-12.8M; double pane, outer and inner pane of Type A float glass, glass thickness to suit opening size and in accordance with applicable Building Code, full 13 mm inter-pane space purged dry and hermetically sealed for total unit thickness of 22 mm. Include Low-e coating on #2 surface, warm edge spacer (Super Spacer or XL bar) and Argon fill for visible light transmission or 70% min., minimum R value of 4.2 (cog) min. and SHGC of 0.44 maximum.
- 2.2 ACCESSORIES
 - .1 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D 2240, 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, size to suit application, black colour.
 - .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption of 25%, to effect an air and vapour seal; size to suit application.
 - .4 Glazing splines: resilient silicone, extruded shape to suit glazing channel retaining slot, colour as selected.
 - .5 Glazing clips: manufacturer's standard type.
 - .6 Lock-strip gaskets: to ASTM C 542.
 - .7 Mirror attachment accessories:

- .1 Stainless steel clips.

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- DRY METHOD (PREFORMED GLAZING)

- .1 Cut glazing tape or spline to length; install on glazing light. Seal corners by butting tape or spline and sealing junctions with sealant.
- .2 Place setting blocks at $\frac{1}{4}$ points, with edge block maximum 150 mm from corners.
- .3 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- .4 Install removable stops without displacing glazing tape or spline. Exert pressure for full continuous contact.
- .5 Trim protruding tape edge.

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 $\frac{1}{4}$ points, with edge 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 in accordance with manufacturer's instructions to be tamperproof.
- .2 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. Do not mark heat absorbing or reflective glass units.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Wood Framing Section 06 11 00
- .2 Finish Carpentry Section 06 20 00
- .3 Vapour and Air Barriers Section 07 27 00

1.2 REFERENCES

- .1 Aluminum Association
 - .1 Designation for Aluminum Finishes- 1997
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 36-95, Specification for Gypsum Wallboard.
 - .2 ASTM C 79-94, Specification for Gypsum Sheathing Board.
 - .3 ASTM C 442-92, Specification for Gypsum Backing Board and Coreboard.
 - .4 ASTM C 475-94, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .5 ASTM C 514-94, Specification for Nails for the Application of Gypsum Board.
 - .6 ASTM C 557-93a, Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - .7 ASTM C 630-93, Specification for Water-Resistant Gypsum Backing Board.
 - .8 ASTM C 840-95, Specification for Application and Finishing of Gypsum Board.
 - .9 ASTM C 954-93, Specification for Steel Drill Screws for the Application of Gypsum Board.
 - .10 ASTM C 1002-93, Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
 - .11 ASTM C 1047-94, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .12 ASTM C 1280-94, Specification for Application of Gypsum Sheathing Board.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .2 CAN/CGSB-71.25-M88, Adhesive for Bonding Drywall to Wood Framing and Metal Studs.
- .4 Underwriter Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-1988, Building Materials and Assemblies.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Standard board: to ASTM C 36 regular, 13 mm thick, 16 mm thick and 16 mm Type X, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.

- .2 Gypsum sheathing board: to ASTM A 79, regular, 16 mm thick and Type X, 16 mm thick, 1200 mm wide x maximum practical length.
- .3 Water-resistant board: to ASTM C 630 regular, 12 mm thick and Type X, 12 mm thick, maximum practical length.
- .4 Nails: to ASTM C 514.
- .5 Steel drill screws: to ASTM C 1002.
- .6 Stud adhesive: to CAN/CGSB-71.25.
- .7 Laminating compound: as recommended by manufacturer, asbestos-free.
- .8 Sealants: in accordance with Section 07 92 00.
- .9 Acoustic sealant: See Section 07 92 00.
- .10 Polyethylene: to CAN/CGSB-51.34, Type 2.
- .11 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .12 Joint compound: to ASTM C 475, asbestos-free.

PART 3 EXECUTION

3.1 ERECTION

- .1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.
- .2 Do application of gypsum board sheathing in accordance with ASTM C 1280.
- .3 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C 840 except where specified otherwise.
- .4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .5 Install Work level to tolerance of 1:1200.
- .6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.
- .7 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .8 Frame above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .9 Install wall furring for gypsum board wall finished in accordance with ASTM C 840, except where specified otherwise.
- .10 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .11 Frame duct shafts, beams, columns, pipes, and exposed services where indicated.
- .12 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm O.C. and not more than 150 mm from ceiling/wall juncture. Secure to each support with 38 mm common nail or 25 mm drywall screw.
- .13 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

3.2 APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical Work are approved.
- .2 Apply single or double layer gypsum board to wood or metal furring or framing using screw fasteners for first layer, screw fasteners for second layer. Maximum spacing using screws 300 mm O.C.
- .3 Apply single or double layer gypsum board to concrete or concrete block surfaces, where indicated, using laminating adhesive. Brace or fasten gypsum board until fastening adhesive has set. Gypsum board shall be mechanically fastened at top and bottom of each sheet.
- .4 Apply water-resistant gypsum board where wall tiles to be applied and adjacent to slop sinks, janitor closets, washrooms, sinks and showers. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.
- .5 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut boxed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.
- .6 On ceilings: Apply base layer prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 300 mm.
- .7 Apply base layers at right angles to supports unless otherwise indicated.

3.3 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fir corners accurately and free from rough edges. Secure at 150 mm.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Provide continuous polyethylene dust barrier behind and across control joints.
- .6 Locate control joints where indicated on drawings and at a maximum 6 m.
- .7 Install control joints straight and true.
- .8 Apply Fast-Mask trim to all visible surfaces of dissimilar materials: i.e. to timber, PVC, metal, masonry, glass, etc.
- .9 Install access doors to electrical and mechanical fixtures specified in respective Sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .10 Finish face panel joints and internal angles with joint systems consisting of joint compound, joint tape, and taping compound installed according to manufacturer's directions and feathered onto panel faces.
- .11 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

- .12 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .13 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .14 Completed installation to be smooth, level or plumb, free from wavers and other defects and ready for surface finish.
- .15 Remove ridges by light sanding or wiping with damp cloth.
- .16 Install sound attenuation blankets where indicated.
- .17 Install ceiling boards in the direction that will minimize the number of end-but joints. Stagger end joints at least 300 mm.
- .18 Install gypsum board on wall vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes for fire-rated assemblies require vertical application.
- .19 Install gypsum board with face side out. Do not install damaged or damp boards.
- .20 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite wall.
- .21 Construct fire rated assemblies where indicated.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Vapour and Air Barriers Section 07 27 00
- .2 Sheet Metal Flashings and Trim Section 07 62 00

1.2 REFERENCES

- .1 Portland Cement Plaster Stucco Manual.

1.3 SAMPLES

- .1 Submit 2' x 2' painted sample. Max 6 different colours.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Do not apply stucco when substrate or ambient air temperature is less than 10 degrees C.
- .2 Maintain minimum ambient temperature of 10 degrees C during and after installation of stucco.

PART 2 PRODUCTS

2.1 TYPES

- .1 Stucco type: Skid Trowel – on final stucco level coat with dryuit sandblast texture DPR-finish.

2.2 MATERIALS

- .1 Cement: CAN3-A5M, Portland Type, Symbol 10, White or grey as selected by Contract Administrator.
- .2 Lime: Hydrated finishing lime conforming with current CSA Specification
- .3 Sand: CSA A.82.57 – 1954; clean, coarse, sharp, well screened.
- .4 Water: Clean, fresh, potable and free of mineral or organic matter which can affect stucco.
- .5 Colour to match paint sample – selected by Contract Administrator.

2.3 ACCESSORIES

- .1 Sheet Air Barrier/Building Paper: DuPont Tyvek Housewrap as per Section 07 27 00.
- .2 Wire Mesh Reinforcement: 38 x 38 mm hot dipped galvanized steel 0.6 mm wire, woven mesh, self furring type.
- .3 Corner Beads, Base Screeds, Casing Beads, Stops, Control Joints: Formed steel, minimum 0.5 mm thick, expanded metal flanges, hot dipped galvanized finish; thickness to suit stucco thickness.
- .4 Flashings: As specified in Section 07 62 00.

Anchorage: Nails, staples, or other approved metal supports, of type and size to suit application, hot dipped galvanized, to rigidly secure reinforcement and associated metal accessories in place.

Pre-Fin Wall Trims: Reveal 2" – pre-fin to match flash flashing.

2.4 MIX DESIGN

- .1 Develop stucco mix design in accordance with CSA A82.30M.
- .2 Mix materials dry, to uniform colour and consistency, before adding water unless manufacturers written recommendation states otherwise.
- .3 Protect mixtures from frost, contamination and evaporation.
- .4 Do not retemper mixes after initial set has occurred.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify that surfaces and site conditions are ready to receive Work.
- .2 Grounds and Blocking: Verify items within walls for other sections of Work have been installed.
- .3 Mechanical and Electrical: Verify services within walls have been tested and approved.
- .4 Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- .1 Protect surfaces near the Work of this section from damage or disfiguration.

3.3 INSTALLATION – REINFORCEMENT

- .1 Wrap exterior of structure with sheet air barrier/building paper to areas indicated on the drawings. Secure to substrate with staples as sheet barrier is being unrolled to prevent billowing. Lap horizontal and vertical joints minimum 300 mm. At openings in the exterior wall cut an 'X' through the sheet barrier and return the sheet barrier to the inside framing.
- .2 At external and internal corners, install a 150 mm wide strip of expanded metal lath bent to conform to angle or corner, with equal legs each side of corner.
- .3 Install reinforcement over underlayment, with long dimension horizontal, lapping joints not less than 25 mm, lapping upper courses over lower courses, and lapping ends.
- .4 Install casing beads, control joints, stops and screeds at locations as shown on drawings. Install straight, plumb, level, rigid and in the proper plane. Use full length pieces to minimize joints. Fit lengths together without gaps, accurately align and rigidly secure each side of joints. Mitre and fit corners accurately, without rough edges.

3.4 STUCCO APPLICATION

- .1 Apply scratch coat to a nominal thickness of 9 mm with sufficient material and force to form good key. Moist cure.
- .2 Apply brown coat to nominal thickness of 9 mm, bring out grounds, straighten to true surface, float and compact. Moist cure.
- .3 After curing, dampen brown coat prior to applying finish coat.
- .4 Apply float finish coat to a nominal thickness of 6 mm. Float/trowel to reach desired surface texture. Avoid excessive working of surface. Delay towelling as long as possible to avoid drawing excess fines to surface.
- .5 Moist cure finish coat for minimum period of 48 hours.

3.5 TOLERANCES

- .1 Maximum variation from true flatness: 3 mm in 3m.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Submittal Procedures Section 01 33 00

1.2 WORK INCLUDED

- .1 The Work included under this section shall conform to the industry standard and be accepted by the local construction and trade associations.

1.3 QUALITY ASSURANCE

- .1 Conform to TTMAC requirements for Quarry Tile Manual and Maintenance Guide.

1.4 SUBMITTALS

- .1 Submit samples to requirements of Section 01 33 00.
- .2 Include cleaning methods, cleaning solutions recommended, stain removal methods, and polishes and waxes recommended.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Porcelain Floor Tile (at Entry): to be 12 x 12 6" 150 base. Olympia tile – Pizzara Series Porcelain Green R22.

2.2 MORTAR MATERIALS

- .1 Mortar Materials: TTMAC requirements for Portland cement, sand, and water.

2.3 MORTAR BED

- .1 Mortar Bed: Latex – reinforced thinset mortar, as recommended by manufacturer.

2.4 GROUT TYPE

- .1 Grout: Sanded grout with acrylic additive.

2.5 TRIM

- .1 Purpose made tile trim by Schluter Systems (Canada) (800) 361.3127. Suit to tile thickness. Finish and colour to be determined by Contract Administrator. At floor/wall junctions: DILEX-EKE; at tile edge at junction with carpet: SCHEINE-M; at external corners: RONDEC. Contour edge transition CT-XX or CCA-XX as required, color as selected by Contractor Administrator or approved equal in accordance with B6.

2.6 SURFACE PREPARATION MATERIALS

- .1 Spot patching and build up not more than 13mm: Ultra/Plan self-leveling cementitious underlayment compound.
- .2 Build up greater than 13mm: Planirete 50 additive with sand/cement mortar.

PART 3 EXECUTION

3.1 INSPECTION

- .1 Verify that surfaces are ready to receive Work.
- .2 Beginning of installation means acceptance of substrate.

3.2 INSTALLATION

- .1 Install quarry tile floor and base in accordance with TTMAC.
- .2 Lay tile to pattern indicated. Verify pattern is uninterrupted through openings.
- .3 Cut and fit tile tight to protrusions and vertical interruptions. Form corners and bases neatly.
- .4 Work tile joints uniform in width, subject to variance in tolerance allowed in tile size. Joints: Watertight, without voids, cracks, excess mortar, or grout.
- .5 Allow tile to set for a minimum of 48 hours prior to grouting.
- .6 Cut wall tile to ½ width at all curves.

3.3 CLEANING

- .1 Clean quarry tile surfaces in accordance with TTMAS Maintenance Guide.
- .2 Prohibit traffic from floor finish for 48 hours after installation.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Suspended metal grid ceiling system.
- .2 Acoustical tile.
- .3 Non-fire rated assembly.
- .4 Perimeter trim.
- .5 Suspended Louvre Ceilings.

1.2 REGULATORY REQUIREMENTS

- .1 Flame spread rating and smoke development to conform to National Building Code and the Manitoba Building Code.

1.3 SAMPLES

- .1 Submit samples to requirements of Section 01 00 00.
- .2 Submit one sample 12" x 12" illustrating material and finish of each type of acoustic unit.
- .3 Submit one sample each, of suspension system main runner, cross runner, and edge trim.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Perform work to requirements of Division 01.
- .2 Maintain uniform temperature of minimum 16 degrees C, and humidity of 20 to 40 percent prior to, during, and after installation.
- .3 Store material in work area 48 hours prior to installation.

1.5 SEQUENCING/SCHEDULING

- .1 Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- .2 Schedule installation of acoustic units after interior wet work is dry.

1.6 EXTRA STOCK

- .1 Provide extra quantity of acoustic units for maintenance use amounting to 2% of gross ceiling area for each type required for project. Store where directed and identify contents.
- .2 Maintenance materials to be from same production run as installed materials.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- .1 Acoustic Unit materials
 - .1 Armstrong
 - .2 Canadian Gypsum Co.
 - .3 Celotex

2.2 ACOUSTIC UNIT MATERIALS

- .1 Acoustic Tiles (Lap 1): 5/8" thick mineral fibre "Cortega" second look II 2776 manufactured by Armstrong; square edge; 24: x 48"; Colour to be white.
- .2 Acoustic Tiles (Lap 2): (Basement) 3/4 HR Fire resistive ceiling assemblies by Armstrong; white cortega square lay-in acoustic tiles.

2.3 SUSPENSION SYSTEM MATERIALS

- .1 Grid: Intermediate non-fire rated and fire rated exposed T components die cut and interlocking.
- .2 Accessories: Stabilizer bars, clips, splices, edge moldings, hold down clips required for suspended grid system.
- .3 Grid materials: Commercial quality cold rolled steel with galvanized coating.
- .4 Grid Finish: White.
- .5 Support Channels and Hangers: Galvanized steel; size and type to suit application, to rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.
- .6 Grid components: galvanized steel die cut main tee with double web, rectangular bulb and 1: rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersections.

PART 3 EXECUTION

3.1 INSPECTION

- .1 Verify that surfaces are ready to receive work instructed by the manufacturer.
- .2 Verify that layout of hangers will not interfere with other work.
- .3 Beginning of installation means acceptance of site conditions.

3.2 INSTALLATION

- .1 Install acoustic tile and luminous grid systems in accordance with manufacturer's instructions and as supplemented in this section.
- .2 Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- .3 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- .4 Supply hangers or inserts for installation with instructions for their correct placement.
- .5 Hang system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- .6 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- .7 Locate system on room axis according to reflected plan.
- .8 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6" of each corner; or support components independently.
- .9 Do no eccentrically load system, or produce rotation of runners.

- .10 Install edge moulding at intersection of ceiling and vertical surfaces, using longest practical lengths. Mitre corners. Provide edge mouldings at junctions with other interruptions.
- .11 Form expansion joints to accommodate plus or minus 1" movement. Maintain visual closure.
- .12 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- .13 Install acoustic units level, in uniform plane, and free from twist, war and dents.

3.3

TOLERANCES

- .1 Variation from Flat and Level Surface: 1/8" / 3 FT.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Preparation of substrate surfaces.
- .2 Vinyl composition floor tile.
- .3 Rubber floor tile/treads.
- .4 Base materials and edge guards
- .5 Clean up all surfaces and areas of work.

1.2 RELATED SECTIONS

- .1 Carpeting Section 09 68 23

1.3 REFERENCES

- .1 ASTM E84 – Surface Burning Characteristics of Building Materials.
- .2 CSA A126 – Sheet Flooring Products

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 00 00.
- .2 Include duplicate 12"x 12" sized samples of each flooring material, color and pattern selected.

1.5 MAINTENANCE DATA

- .1 Provide manufacturers instructions covering care and maintenance of materials of this section.

1.6 EXTRA MATERIALS

- .1 Provide 5% or 50 sf, whichever is greater, of each colour and type of flooring, base and stair materials for project for maintenance use. Store where directed. Identify each roll or container.

PART 2 PRODUCTS

2.1 FLOORING MATERIALS

- .1 Rubber Flooring System – Johnsonite speckled colorway – hammered finished – artisan collection – submit sample. One-piece tread/riser at stair.
- .2 Vinyl Composition Floor Tile: Mannington Brush Work 713 Florentine.
- .3 Vinyl Composition Floor Tile: (Accent colour) Mannington Brush Work 731 Mars Black.

2.2 ACCEPTABLE MANUFACTURERS – BASE

- .1 Finecraft
- .2 Amtico
- .3 Johnsonite

2.3 BASE MATERIALS

- .1 Rubber Base: Roll stock 4" or 6" high, 1/8" thick, top set covered.

2.4 EDGE GUARD MATERIALS

- .1 Edge Guards: Rubber Binder Bar: Black.

2.5 ACCESSORIES/ADHESIVES/SEALERS

- .1 Sub-Floor Filler: trowelable cement based floor filler; Ardex K-55 or type recommended by flooring material manufacturer.
- .2 Primer and adhesives: waterproof, of types recommended by flooring manufacturer for specific material.
- .3 Sealer and Polish: type recommended by flooring material manufacturer for material type and location.

PART 3 EXECUTION

3.1 SITE AND SUBSTRATE CONDITIONS

- .1 Install underlayment riverside uclay – 5/16" on firm and solid existing substrate. Remove existing flooring as required.
- .2 Ensure floor surfaces are smooth and flat with maximum variation of 1/4" in 10 ft.
- .3 Maintain minimum 70 degrees F. air temperature at flooring installation area for 72 hours prior to, during and for 48 hours after installation.
- .4 Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- .1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- .2 Clean floor and apply, trowel and float filler to leave smooth, flat hard surface. Prohibit traffic until filler is cured.
- .3 Apply primer to concrete surfaces, to flooring manufacturers recommendations.

3.3 INSTALLATION – RUBBER BASE MATERIALS

- .1 Fit joints tight and vertical. Maintain minimum measurement of 2' – 0" between joints.
- .2 Mitre internal corners.
- .3 Install base on solid blocking. Bond tight to wall.
- .4 Scribe and fit to door frames and other interruptions.

3.4 PROTECTION

- .1 Prohibit traffic from floor finish for 48 hours after installation.

3.5 CLEAN-UP

- .1 Remove excess adhesive from floor, base and wall surfaces and leave free of damage.
- .2 Clean, seal and polish floor and base surfaces in accordance with manufacturers recommendations.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Carpeting glue down method, to floors.
- .2 Accessories.
- .3 Preparation of substrate surfaces.

1.2 RELATED SECTIONS

- .1 Resilient Flooring Section 09 65 10

1.3 REFERENCES

- .1 CAN4-S10-2M – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN4-S102.2M – Standard Method of Test for Surface Burning Characteristics for Flooring, Floor Covering and Miscellaneous Materials.
- .3 CGSB4 – GP-129 – Carpets, Commercial
- .4 CGSB4 – GP-156 – Guide to Selection and Installation of Direct Glue-Down Carpet.
- .5 CGSB 71 – GP-28M – Adhesive for Direct Glue-Down Carpet Installation.

1.4 REGULATORY REQUIREMENTS

- .1 Flame Spread rating and smoke development not to exceed the National Building Code Subsection – Interior Finish.

1.5 SAMPLES

- .1 Submit two samples 12" x 12" in size, illustrating colour and pattern for each carpet material specified.

1.6 OPERATION AND MAINTENANCE DATA

- .1 Submit operation and maintenance data to requirements of Section 01 00 00.
- .2 Include maintenance, procedures, recommended maintenance materials, and suggested schedule for cleaning and shampooing.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Store materials for 3 days prior to installation in area of installation to achieve temperature stability.
- .2 Maintain minimum 21 degrees C. ambient temperature three days prior to, during, and 24 hours after installation materials.

1.8 GUARANTEE

- .1 Manufacturer to provide a written guarantee, stating that the carpeting work of this section is guaranteed against deterioration or backing, delamination, stretching or wrinkling, fading or other defects of materials or workmanship detrimental to appearance of performance for a period of ten (10) years from the date of Final Certificate of Completion. Carpets shall be warranted against excessive surface wear meaning more than 10% loss of pile fibre for a period of ten years and shall include replacement of defective work at no expense to the City.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Patcraft – Anthology 10086–86519 collection.
- .2 Adhesives: waterproof, non-release brand recommended by the carpet manufacturers for their particular products.
- .3 Sub Floor Filler: type recommended by carpet manufacturer.
- .4 Carpet Base: 4" high carpet with bound edge of solid ribbon – material sewn with nylon threading, colour to match carpet.

PART 3 EXECUTION

3.1 INSPECTION

- .1 Verify that surfaces are smooth and flat with maximum variation of 1/8" in 10' and are ready to receive work.
- .2 Verify concrete surfaces are dry by using test methods recommended by flooring manufacturer and exhibit negative alkalinity, carbonization or dusting.
- .3 Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION (CONCRETE SURFACES)

- .1 Remove substrate ridges and bumps. Fill depressions cracks, joints, holes, and other defects with filler.
- .2 Apply, trowel and float filler to leave smooth, flat, hard surface.
- .3 Prohibit traffic until filler is cured, then vacuum floor surface.
- .4 Ensure floors are free of dust, dirt, solvents, oil, grease, paint, plaster and all other substances detrimental to the performance of the adhesive and carpet.
- .5 Install underlayment riverside ulay – 5/16".

3.3 INSTALLATION

- .1 Apply carpet and adhesive in accordance with manufacturers instructions to CGSB 4-GP-156.
- .2 Lay out rolls of carpet for approval.
- .3 Double cut carpet to allow intended seam and pattern match. Make cuts straight, true and unfrayed where carpet abuts dissimilar materials.
- .4 Locate seams in area of least traffic.
- .5 Fit seams straight, not crowded or peaked, free of gaps.
- .6 Lay carpet on floors with run of pile in same direction as anticipated traffic.
- .7 Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change or colour of pattern between rooms under door centerline.
- .8 Cut and fit carpet around interruptions.
- .9 Fit carpet tight to intersection with vertical surfaces without gaps.

- .10 Install edge guards where carpet abuts dissimilar material. Use full length pieces only. Do not splice within 24" of corners or ends. Butt ends tight and flush where splicing cannot be avoided.
- 3.4 PROTECTION
 - .1 Prohibit traffic from carpet areas for 24 hours after installation
 - .2 Protect traffic areas of carpeted floors with polyethylene drop sheets. Tape edges and joints to prevent shifting.
- 3.5 CLEANING
 - .1 Remove excess adhesive from floor, base, and wall surfaces without damage.
 - .2 Clean and vacuum carpet surfaces.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Surface preparation.
- .2 Wall covering.

1.2 SAMPLES

- .1 Submit two samples 12" x 12" in size illustrating colour, finish and texture.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Store and protect products.
- .2 Accept roll materials on site and verify no damage.
- .3 Protect packaged adhesive from temperature cycling and cold temperatures.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Do not apply adhesive when substrate surface temperature or ambient temperature is below 15 degrees C. or relative humidity is above 40 percent.
- .2 Maintain these conditions 24 hours before during and after installation of adhesive wall covering.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Metro Wallcovering – Inspiration – Whispertex 3 – Acousticals for vertical surfaces – harvest #60-49.
- .2 Adhesive: Type recommended by wall covering manufacturer to suit application to substrate, water based.
- .3 Substrate Primer and Sealer: as recommended by adhesive manufacturer.

PART 3 EXECUTION

3.1 INSPECTION

- .1 Verify that surfaces are prime painted and ready to receive work and opening dimensions are as indicated in drawings.
- .2 Verify surfaces flatness tolerances does not vary more than 1/8" / 10ft.
- .3 Beginning of installation means acceptance of existing surfaces.

3.2 PREPARATION

- .1 Fill cracks and smooth irregularities with filler; sand smooth.
- .2 Wash surfaces with trisodium phosphate, rinse and neutralize, wipe dry.
- .3 Sand glossy surfaces. Shellac seal marks which may bleed.
- .4 Remove electrical wall plates and covers.
- .5 Vacuum clean surfaces free of loose particles.

3.3 INSTALLATION

- .1 Apply adhesive and wall covering in accordance with manufacturer's instructions.
- .2 Apply adhesive to wall surface in accordance with manufacturer's instructions.
- .3 Use wall covering in roll number sequence.
- .4 Razor trim edges on flat work table.
- .5 Apply covering smooth, butting edges tight. Do not razor cut on gypsum board surfaces.
- .6 Apply fabric smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- .7 Horizontal seams or cutting at corners are not acceptable.
- .8 Do not seam within 2" of inside corners or within 6" of external corners.
- .9 Remove excess wet adhesive from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.4 CLEANING

- .1 Clean wall coverings of excess adhesive, dirt and other contaminants.
- .2 Replace wall plates and accessories removed prior to work of this section.

3.5 PROTECTION

- .1 Protect finished installation and adjacent work.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 All labour, materials, tools and other equipment, services and supervision required to complete all exterior and interior painting and decorating work as indicated on Finish Schedules and to the full extent of the drawings and specifications.

1.2 RELATED WORK

- .1 Finish Carpentry Section 06 20 00
- .2 Architectural Woodwork Section 06 41 11
- .3 Aluminum Doors and Frames Section 08 41 13
- .4 Wood Doors Section 08 14 16
- .5 Gypsum Board Section 09 21 16
- .6 Division 23 – Mechanical
- .7 Division 26 – Electrical

1.3 REFERENCES

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI)

1.4 SAMPLES

- .1 Submit samples in accordance with section 01 33 00 – Submittal Procedures
- .2 Submit samples in duplicate of each colour selected in 300 mm x 300 mm sizes.

1.5 QUALITY ASSURANCE

- .1 Do not apply paint finish in areas where dust is being generated.
- .2 The Contractor shall have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of Work that he will maintain a qualified crew of painters throughout the duration of the Work. When requested, the Contractor shall provide a list of the last three comparable jobs including name and location, specifying authority/project manager, start/completion dates and value of the painting work.
- .3 Only qualified persons, as defined by local jurisdiction shall be engaged in painting and decorating work.
- .4 All materials, preparation and workmanship shall conform to requirements of the LATEST EDITION of the Architectural Painting Specification Manual by Master Painters Institute (MPI)- hereafter referred to as the MPI Painting Manual- as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
- .5 All paint manufacturers and products used shall be as listed under the Approved Product List section of the MPI Painting Manual.

1.6 MAINTENANCE MATERIALS

- .1 At project completion, provide 5 gallons of each type and colour of paint from the same production run (batch mix) in unopened cans, properly labelled and identified for City's later use in maintenance.

1.7 GUARANTEE

- .1 Furnish either the local MPI Accredited Quality Assurance Association's two (2) year guarantee, or alternatively, a 100% two (2) year Maintenance Bond- both in accordance with MPI Painting Manual requirements. The Maintenance Bond shall warrant that all painting work has been performed in accordance with MPI Painting Manual requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Paint materials: only materials listed in the latest edition of the MPI Approved Product List (APL) are acceptable for use on this project. All such material shall be a single manufacturer for each system used.
- .2 Acceptable products
 - .1 Benjamin Moore- Cloverdale, ICI Delux Lifemaster.- Low VOC, low odour. Choice of full range of colours.
- .3 Other material such as linseed oil, shellac, thinners, solvents, etc. shall be the highest quality product of an MPI listed manufacturer and shall be compatible with paint materials being used as required.
- .4 All materials used shall be lead and mercury free and shall have low VOC content where possible.
- .5 All paint materials used shall have good flowing and brushing properties and shall dry or cure free of blemishes, sags, air entrapment etc.
- .6 Where required, paints and coatings shall meet flame spread and smoke development ratings designated by local Code requirements and/or authorities having jurisdiction.
- .7 Unless otherwise specified herein, all painting work shall be in accordance with MPI Premium Grade finish requirements.
- .8 Colours shall be as selected by the Contract Administrator from a manufacturer's full range of colour. Refer to finish schedules and drawings for identification and location of colours.

PART 3 EXECUTION

3.1 GLOSS/SHEEN RATINGS

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

Gloss Level Category	Units @ 60 deg	Units @ 85 deg
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	

3.2 CONDITION OF SURFACES

- .1 Prior to commencement of the Work in this section, thoroughly examine (and test as required) all conditions and surfaces scheduled to be painted and report in writing to the Contractor and the Contract Administrator any conditions or surfaces that will adversely affect work of the section.
- .2 No painting work shall commence until all such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Contractor and the Contract Administrator.
- .3 Commencement of the Work shall not be held to imply acceptance of surfaces except as qualified herein. Such surfaces as concrete, masonry, structural steel and miscellaneous metal, wood, gypsum board, and plaster, shall not be the responsibility of the Painting Sub-Contractor.
- .4 The Painting Sub-Contractor shall not be responsible for the condition of the substrate or for correcting defects and deficiencies in the substrate, which may adversely affect the painting work except for minimal work, normally performed by the Painting Sub-trade and as indicated herein. It shall always, however, be the responsibility of the Painting Sub-trade to see that surfaces are properly prepared before any paint or coating is applied.

3.3 PREPARATION OF SURFACES

- .1 Prepare all surfaces in accordance with MPI requirements. Refer to the MPI Painting Manual in regard to specific requirements.
- .2 Sand, clean, dry, etch, neutralize and/or test all surfaces under adequate illumination, ventilation and temperature requirements.
- .3 Remove and securely store all miscellaneous hardware and surface fittings/fastenings {e.g. electrical plates, mechanical louvers, door and window hardware (hinges, knobs, locks, trim, frame stops) removable rating/hazard/instruction labels, washroom accessories, light fixture trim, etc.}, from wall and ceiling surfaces, doors and frames, prior to painting. Carefully clean and replace all such items upon completion of painting work in each area, do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes). Doors shall be removed before painting to paint bottom and top edges, and then re-hung.
- .4 Protect all adjacent interior surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
- .5 Substrate defects shall be made good and sanded by others ready for painting, particularly after the first coat of paint. Start of finish painting of defective surfaces (e.g. Gypsum board) shall indicate acceptance of the substrate and any costs of making good defects shall be borne by the painter, including repainting of entire surface (no touch-up painting).

3.4 APPLICATION

- .1 Do not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other sub trade work) are acceptable for applications of products.
- .2 Apply paint or stain in accordance with MPI Painting Manual Premium Grade finish requirements.

- .3 Apply paint and decorating material in a workmanlike manner using skilled and trade qualified applicators as noted under Quality Assurance.
- .4 Apply paint and coatings within an appropriate time frame after cleaning when environmental conditions encourage flashing-rusting, rusting, contamination or the manufacturer's paint specifications require earlier applications.
- .5 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .6 Tint each coat of paint progressively lighter to enable confirmation of number of coats.
- .7 Unless otherwise approved by the Contract Administrator, apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.
- .8 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm (39").
- .9 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
- .10 Prime coat of stain or varnish finishes may be reduced in accordance with manufacturer's directions.
- .11 Paint finish shall continue through behind all wall-mounted items (e.g. chalk and tack boards).

3.5 MECHANICAL/ELECTRICAL EQUIPMENT AND RELATED SECTIONS

- .1 Unless otherwise specified or noted, paint all "unfinished" conduits, piping, hangers, ductwork, and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:
 - .1 Where exposed-to-view in all exterior (includes roof-top units) and interior areas.
 - .2 In all interior high humidity interior areas.
 - .3 In all boiler room, mechanical and electrical rooms.
- .2 In unfinished areas, leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .4 Do not paint over nameplates.
- .5 Paint the inside of all ductwork where visible behind louvers, grilles and diffusers for a minimum of 460 mm (18") or beyond sight line, whichever is greater, with primer and one coat of matt black (non-reflecting) paint.
- .6 Paint the inside of light valances gloss white.
- .7 Paint disconnected switches for fire alarm system and exit light systems in red enamel.
- .8 Paint red or band on all fire protection piping and sprinkler lines in accordance with mechanical specification requirements. Keep sprinkler heads free of paint.
- .9 Paint yellow or band on all natural gas piping in accordance with mechanical specification requirements.

- .10 Back prime and paint face and edges of plywood service panels for telephone and electrical equipment before installation to match adjacent wall surface. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
 - .11 Paint exterior steel electrical light standards. Do not paint outdoor transformers and substation equipment.
 - .12 Paint parking stall and parking symbol on concrete paving as indicated on drawing.
- 3.6 FIELD QUALITY CONTROL AND STANDARD OF ACCEPTANCE
- .1 All surfaces, preparation and paint applications shall be inspected.
 - .2 Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Painting Inspection Agency inspector:
 - .1 Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
 - .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 - .3 Damage due to touching before paint is sufficiently dry or any other contributory cause.
 - .4 Damage due to application on moist surfaces or caused by inadequate protection from the weather.
 - .5 Damage and/or contamination of paint due to blown contaminants (dust, spray, paint, etc.)
 - .3 Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
 - .1 Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
 - .2 Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
 - .3 Visible defects are evident on ceiling, soffit, and other overhead surfaces when viewed at normal viewing angles.
 - .4 When the final coat on any surface exhibits a lack of uniformity of colour, sheen, texture, and hiding across full surface area.
 - .4 Painted surfaces rejected by the Contract Administrator shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.
- 3.7 PROTECTION
- .1 Protect all exterior surfaces and areas, including landscaping, walks, drives, all adjacent building surfaces (including glass, aluminum surfaces, etc.) and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.

- .2 Protect all interior surfaces and areas, including glass, aluminum surfaces, etc., and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
 - .3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around Work area as required.
- 3.8 CLEAN-UP
- .1 Remove all paint where spilled, splashed, splattered, or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
 - .2 Keep work area free from unnecessary accumulation of tools, equipment, surplus materials and debris.
 - .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
 - .4 Clean equipment and dispose of wash water/solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction.
- 3.9 INTERIOR FINISHES
- .1 For poured concrete walls: Concrete blocks, hollow core ceiling, INT 4.2 Alkyd G5.
 - .2 For plaster and gypsum board walls and ceilings: INT 9.2B Architectural Latex: Walls G3, Ceilings G1.
 - .3 For primed ferrous metal surfaces: INT 5.1E Alkyd G5.
 - .4 For galvanized and zinc-coated metal: INT 5.3C Alkyd G5.
 - .5 For insulation covering: INT 5.5A Alkyd G5.
 - .6 For copper piping and fittings: INT 5.5A Alkyd G5.
- 3.10 EXTERIOR FINISHES
- .1 For wood to receive paint finish: Ext 6.3B Alkyd G5.
 - .2 For primed ferrous metal surfaces: Ext 5.1D Alkyd G5
 - .3 For galvanized and zinc-coated metal: Ext 5.3B Alkyd G5.

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including instructions to Bidders, Supplementary instructions to Bidders, General Conditions, Specification Sections apply to work of this Section.

1.2 DESCRIPTION

- .1 Work described in this section includes providing equipment, incidental material and labour required for complete, operable hydraulic platform lift installation. Where singular reference is made to lifts or lift components, such reference shall apply to number of lifts or components required to complete installation. This specification provides a broad outline of required equipment and does not describe the details of design and construction. Lifts shall be erected, installed, adjusted, tested and placed in operation by lift system manufacturer, or manufacturer's authorized installer.
- .2 Lifts shall be in accordance with the ASME A18.1 and ADA compliant including local codes and regulations except where specified otherwise.
- .3 The lift described here, manufactured by Savaria Corporation Inc., is a vertical platform lift consisting of a hydraulic tower with a lifting platform. The platform can be customized to better accommodate a wheelchair user or a person with impaired mobility. The lift can be used indoor or outdoor (with optional package) and in commercial and residential applications.

1.3 PREPARATORY WORK BY OTHERS

- .1 The following preparatory work to receive the lifts specified in this section is part of the work by others:
 - .1 Permanent 120 VAC, 20 amp single phase power to operate lift to be provided from a lockable fused/cartridge type disconnect switch with auxiliary contacts for battery operation. Refer to drawings for permanent power specifications and location of disconnects. Temporary power may be provided to expedite installation of lift.
 - .2 Provide a plumb and square hoistway with smooth interior surfaces, including fascias or furring of the hoistway interior.
 - .3 Provide rough openings per lift contractor's shop drawings.
 - .4 Provide substantial, level pit floor slab as indicated on the lift contractor's shop drawings.

1.4 QUALITY ASSURANCE

- .1 Manufacturer
 - .1 Company with not less than 20 years of experience in the design, fabrication and assembly of vertical platform lifts.
- .2 Subcontractor Qualifications
 - .1 Execute work of this section only by a company that has adequate product liability insurance.
 - .2 Skilled tradesmen must be employees of the installing contractor approved by the lift manufacturer, with demonstrated ability to perform the work on a timely basis.

- .3 Requirements of Regulatory Agencies
 - .1 Fabrication and installation work in compliance with applicable jurisdictional authorities
 - .2 File shop drawings and submissions with local authorities as the information is made available. Company pre-inspection and jurisdictional authority inspections and permits are to be made on timely basis as required.
- .4 Submittals
 - .1 Shop drawings shall show a complete layout of lifting equipment detailing dimensions and clearances as required.
 - .2 The lift contractor shall provide physical samples of all items requiring selection of colour or finish.
- .5 Warranty
 - .1 A warranty of 12 months on labour and materials.

PART 2 PRODUCTS

2.1 PLATFORM LIFT

- .1 Basic of specification is Savaria hydraulic vertical platform lift model V1504-STD:
 - .1 Rated Load 750 lb (340 kg)
 - .2 Rated Speed 2.5 f.p.m. (nominal) (0.13 m/s)
 - .3 Usable Car Dimensions 34" x 54" (864 x 1,372 mm)
 - .4 Levels Services 2,3,4
 - .5 Number of Openings 2
 - .6 Car Access Enter/Exit same side, 90° exit, front/rear
 - .7 Max. Travel 23 feet (7,000 mm)
 - .8 Operations Constant pressure
 - .9 Power Supply 110 volt, 15 amp, 1 phase, 60 Hz
 - .10 Drive System 2:1 Roller chain hydraulic
 - .11 Paint Powder coat finish
 - .12 Emergency Power Battery operation in down direction
 - .13 Controller Electronic-free relay logic
 - .14 Motor/Pump 110VAC, 1.5HP
 - .15 Manual lowering Outside the hoistway at desired landing
 - .16 Colour Almond beige
- .2 Car Enclosure
 - .1 Side guards of platform shall have a steel frame with a powder coat finish and steel panel inserts to a minimum of 42" (1,067 mm) above the upper landing.
 - .2 No platform gate required to allow for ease of operation.\

- .3 Upper gate shall be 42" high x 36" wide, with metal or plexiglass inserts and shall be equipped with interlock, spring hinges and kick plate. Lower door shall be 80" high x 36" wide, with metal or plexiglass inserts and shall be equipped with interlock hydraulic closer and kick plate on both sides. The inside kick plate shall be made of steel.
- .4 Lift shall have manufacturer's standard non-skid flooring.
- .5 Doors and gates shall be flush mounted inside the hoistway as to avoid pinch points and shear hazards.
- .6 Handrail: A single handrail with both ends returned to the side guard shall be located on the control wall of the carriage.

2.2 CAR OPERATION

- .1 Car Operating Panel shall consist of constant pressure buttons or rocker switches, emergency stop/alarm button, on/off key switch and emergency light mounted on a removable stainless steel panel (Type 304#4 Stainless Steel Finish).
- .2 Emergency Operation – The car shall be equipped with a battery operated light fixture, emergency battery lowering device and alarm in case of normal building supply failure. The battery shall be the rechargeable type with an automatic recharging system. A manual lowering device shall be located outside the hoistway in a lockable box positioned at a designated landing.

2.3 PUMPING UNIT AND CONTROL

- .1 The pumping unit and control shall be enclosed in the tower. The controller and pump unit shall be pre-wired and tested prior to shipment. The controller is to be electronic-free with relay logic operation for ease of maintenance and service. Pump unit shall incorporate the following features:
 - .1 Smooth stops at each landing.
 - .2 Adjustable pressure relief valve.
 - .3 Manually operable down valve to lower lift in the event of an emergency. This valve shall be activated from outside of the hoistway through a keyed box.
 - .4 Pressure gauge isolating valve, manually operable.
 - .5 Gate valve to isolate cylinder from pump unit.
 - .6 Electrical solenoid for down direction control
 - .7 Emergency lowering by battery power, from the car control.

2.4 CYLINDER AND PLUNGER

- .1 The cylinder shall be constructed of steel pipe of sufficient thickness and suitable safety margin. The top of the cylinder shall be equipped with a cylinder head with an internal guide ring and self-adjusting packing.
- .2 The plunger shall be constructed of a steel shaft of proper diameter machined true and smooth. The plunger shall be provided with a stop electrically welded to the bottom to prevent the plunger from leaving the cylinder.

2.5 ROLLER CHAINS

- .1 Two (2) No. 50 roller chains with 5/8" pitch. Minimum breaking strength 6400 lb (2773 kg) each.

- 2.6 LEVELLING DEVICE
- .1 The lift shall be provided with an anti-creep device which will maintain the carriage level within ½" (12.69 mm) of the top landing.
 - .2 All limit switch and levelling device switches shall be located in a position to be inaccessible to unauthorized persons. They shall be located behind the mast wall and be accessible through removable panels.
- 2.7 GUIDE YOKE
- .1 The 2:1 guide yoke/sprocket assembly shall be supplied with two (2) sprockets, roller guide shoes, bearings and guards.
- 2.8 CALL STATIONS
- .1 Provide door frame mount key-controlled call stations for upper level and lower level on a stainless steel plate (Type 304#4 stainless steel finish).
 - .2 Provide inter-com system.
- 2.9 TERMINAL STOPPING DEVICES
- .1 Normal terminal stopping devices shall be provided at top and bottom of runway to stop the car positively and automatically. Microswitches shall not be used.
- 2.10 GUIDE RAILS AND BRACKETS
- .1 Steel "C" guide rails and brackets shall be used to guide the platform and sling. Guide rails shall form part of the structural integrity of the unit and be integral to the mast enclosure, ensuring stability and minimum platform deflection when loaded.
- 2.11 CAR SLING
- .1 Car sling shall be fabricated from steel tubing 44" (1.116 mm) high with adequate bracing to support the platform and car enclosure. Roller guide shoes shall be mounted on the top and bottom of the car sling to engage the guide rails. Guide shoes shall be roller types with 3" diameter wheels.
- 2.12 WIRING
- .1 All wiring and electrical connections shall comply with applicable codes. Insulated wiring shall have flame-retardant and moisture-proof outer covering and shall be run in conduit or electrical wireways if located outside the unit enclosure. Quick disconnect harnesses shall be used when possible.
- 2.13 DOOR LOCKS
- .1 The door locks shall be GAL type "N" interlock or fire rated electric door strike conform to ASME A18.1 b 2000.
- 2.14 TOP LANDING GATE
- .1 This gate is installed on the top landing and shall be used with a fire-rated electric door strike or a GAL interlock. The size shall be 42" high and it shall be provided with metal or acrylic insert.
- 2.15 INTER-COM
- .1

PART 3 EXECUTION

3.1 EXAMINATION

- .1 All site dimensions shall be taken to ensure that tolerances and clearances have been maintained and meet local regulations.

3.2 PREPARATION

- .1 Pre-inspect the construction and service requirements for work by others. These requirements will be included in drawings, diagrams, engineering data sheets and special instructions before the work begins.

3.3 INSTALLATION

- .1 Install all the components of the lift system that are specified in this section to be provided and that are required by jurisdictional authorities to license the lift.
- .2 Trained employees of the lift contractor shall perform all installation work of this section.
- .3 Adjust lift for proper operation and clean unit thoroughly.
- .4 Instruct users in operation procedures and the City's maintenance person in trouble-shooting and maintenance procedures.

PART 1 GENERAL

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

- .1 Provide labour, material, equipment and services necessary for and incidental to the supply and installation of the systems shown on the drawings and hereinafter specified.
- .2 Generally this shall include:
 - .1 Sanitary Drainage System
 - .2 Storm Drainage System
 - .3 Cold and Hot Water Supply System
 - .4 Natural Gas Piping System
 - .5 Plumbing Fixtures and Equipment

1.3 REFERENCES

- .1 AGA Z21.22 – Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
- .2 ASME B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.
- .3 ASME B16.3 – Malleable Iron Threaded Fittings.
- .4 ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
- .5 ASME B16.23 – Cast Copper Alloy Solder Joint Drainage Fittings – DWV.
- .6 ASME B16.29 – Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
- .7 ASME B31.2 – Fuel Gas Piping.
- .8 ASME B31.9 – Building Services Piping.
- .9 ASTM A53/A53M – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .10 ASTM A74 – Cast Iron Soil Pipe and Fittings.
- .11 ASTM B42 – Seamless Copper Pipe, Standard Sizes.
- .12 ASTM B251 – General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- .13 ASTM C564 – Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .14 ASTM D1785 – Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- .15 ASTM D2466 – Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- .16 ASTM D2665 – Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- .17 ASTM E814 – Fire Tests of Through-Penetration Fire Stops.
- .18 ASTM F708 – Design and Installation of Rigid Pipe Hangers.

- .19 AWWA C651 – Disinfecting Water Mains.
- .20 CISPI 301 – Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
- .21 CISPI 310 – Joints with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
- .22 MSS SP58 – Pipe Hangers and Supports – Materials, Design and Manufacturer.
- .23 MSS SP69 – Pipe Hangers and Supports – Selection and Application.
- .24 MSS SP89 – Pipe Hangers and Supports – Fabrication and Installation Practices.
- .25 NCPWB – Procedure Specifications for Pipe Welding.
- .26 NFPA 54 – National Fuel Gas Code.
- .27 UL 1479 – Fire Tests of Through-Penetration Firestops.

1.4 RELATED WORK

- .1 Common Work Results – Mechanical Section 23 05 00
- .2 Insulation Section 23 07 12
- .3 HVAC Systems Section 23 54 11
- .4 Controls Section 25 30 00
- .5 Common Work Results – Electrical Section 26 05 00

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

- .1 General
 - .1 Pipe and fittings shall conform to the standards listed in the applicable Building Codes (latest revision).
 - .1 Flanged joints must have suitable gasket and bolts.
 - .2 Use brass nipples between copper piping and flush valves or c.p. brass goods.
 - .3 Where alternate piping materials or jointing are specified a uniform type of pipe and fittings shall be used throughout each system.
 - .2 Drains and vents – storm and sanitary
 - .1 Drains and vent pipes shall be in accordance with local or provincial regulations with the following exceptions, unless otherwise specified.
 - .2 All cast iron soil pipe shall be class 4000.
 - .3 Cast iron soil pipe may be hub and spigot or mechanical joint. Mechanical joint couplings shall have a corrugated stainless steel sleeve over the joint with stainless steel worm drive securing bands tack welded to the sleeve. Titan or approved equal in accordance with B6.
 - .4 Polyvinyl chloride (PVC-DWV) pipe and fittings shall be solvent cement socket weld joint certified to ULC Standard CAN/OLC-S102.2.

- .5 No plastic, asbestos cement or aluminum pipe accepted unless specifically called by the Contract Administrator.
- .3 Water Piping – Domestic Cold, Hot, Hot Water Recirculating,
 - .1 Pipe – Type ‘L’ third party certified hard copper tube to ASTM B.88.
Fittings – Wrought copper or cast brass, solder joint pressure fitting.
Flanges – Cast brass 1034 kPa (150 psi) ANSI B16.24.
- .4 Sewage and Sump Pump Discharge
 - .1 Up to 50mm (2”) Diam: Pipe – DWV copper. Fittings – DWV solder joint pipe.
 - .2 64mm (2 ½”) and larger: pipe – Schedule 40 galvanized steel victaulic roll grooved. Fittings – Victaulic malleable with Victaulic style 07 Zero-flex rigid couplings, flush seal grade ‘0’ gasket.
- .5 Natural Gas Systems
 - .1 Pipe
 - .1 Up to 150mm (6”): - Schedule 40 carbon steel, continuous weld or electric resistance weld pipe conforming to ASTM A53 Grade B.
 - .2 Fittings
 - .1 Up to 50mm (2”):
 - .1 Screwed fittings – 1034 kPa (150 psi) black malleable iron, banded.
 - .2 Socket weld fittings – 13,800 kPa (2000 psi forged steel).
 - .3 Unions – 1034 kPa (150 psi) brass to iron seat.
 - .2 64mm (2 ½”) and larger:
 - .1 Butt welding fittings to be Crane manufactured to ASTM A234. Flanges to be Grinnel forged carbon slip-on welding flanges conforming to ASTM A181, Grade 1. Gaskets to be Cranite pre-formed asbestos. Site or shop cut gaskets unacceptable. Use ring gaskets on raised face flanges and full faced gaskets on flat faced flanges. Use 1034 kPa (150psi) flanges on systems to 689 kPa (100 psi). Thread-O-Lets and Weld-O-Lets to be manufactured to ASTM A181, Grade 1.
- 2.2 WALL SLEEVE SEALS
 - .1 Where water and sanitary service lines are sleeved through concrete wall, provide schedule 40 steel pipe sleeves and LINK-SEAL sleeve seals.
- 2.3 VALVES
 - .1 General
 - .1 Valve parts must be of material recommended by manufacturer for service specified. Valves must be installed with stems upright or horizontal, not inverted. Valves not specifically covered herein shall be of comparable quality to those specified.

- .2 Water
 - .1 Domestic cold, hot, hot recirculating:
 - .1 All valves up to 19mm (3/4") ball valves, bronze body (Appollo, Conbraco).
 - .2 Gate valves up to 50mm (2"): bronze body Crane 1334, Newman Hattersley T609, Kitz 43, Nibco S-134.
 - .3 Globe valves up to 50mm (2") bronze body – Toyo 221, Crane 1310, Newman Hattersley Fig. 13, Kitz 10, Nibco S-235Y.
 - .4 Swing check valves up to 50mm (2"): bronze body – Toyo 237, Crane 1342, Newman Hattersley A61, Nibco S413B.
 - .5 Spring loaded check valves up to 50mm (2"): bronze body MAS-700.
 - .6 Ball balancing valves with balancing plate up to 50mm (2"): bronze body – Toyo Fig. 5049A, Newman Hattersley 1979, Kitz 59, Crane 9322, Nibco S-585-70.
 - .7 Ball valves up to 50mm (2"): bronze body – Toyo Fig. 5049A, Newman Hattersley 1979, Kitz 59, Crane 9322, Nibco S-585-70.
 - .2 Sump and sewage pump discharge:
 - .1 Gate valves up to 50mm (2"): bronze body – Crane 1334, Newman Hattersley T609, Kitz 43, Nibco S134.
 - .2 Gate valves 64mm (2 1/2"): Crane 465-1/2, Newman Hattersley 504, Nibco F-617-0.
 - .3 Check valves up to 50mm (2"): Crane 1342, Toyo 237, Newman Hattersley A61, Nibco S413B.
 - .3 Drain valves up to and including 19mm (3/4"): Toyo Fig. 5046 ball valve with garden hose threaded outlet complete with chain and cap.
 - .4 Drain valves 25mm (1") and larger: Gate valves as specified above, with discharge piped to suitable drain.
 - .3 Natural Gas
 - .1 Valves up to 50mm (2") size – Toyo 5044A and Kitz Code No. 58 ball valve or Newman Hattersley 1969F. Newman-Milliken 200M, lubricated screwed plug valve.
 - .2 Valves 64mm (2 1/2") and larger: Newman-Milliken 201M flanged plug valve. Newman-Milliken 200M, lubricated screwed plug valve.
- 2.4 STRAINERS
 - .1 Water Systems:
 - .1 Up to 50mm (2") size – screwed bronze body Y pattern, with stainless steel perforated screen Newman Hattersley 807, Spirax Sarco Type BT.
 - .2 64mm (2 1/2") and larger – Spriax Sarco Type 733-125, flanged cast iron body basket type screen with bolted cover and drain plug, perforated stainless steel screen, w.p. 860 kPa (125 psig).
 - .3 Perforation Sizes: On pump suction – 3mm (1/8"). All other – 1.5mm (1/16").

2.5 EXPANSION JOINTS

- .1 Copper Pipe sizes 75mm (3") and under:
 - .1 FLEXONICS Model HB bronze expansion compensators designed for the pressure to be external to the 2-ply bronze bellows for positive squirm elimination, and complete with anti-torque device, limit stops, internal guides with female streamline ends. All brazed joints to be by heliarc process.
 - .2 Steel Pipe sizes over 75mm (3") and under:
 - .1 FLEXONICS Model H expansion compensators designed for the pressure to be external to the 2-ply stainless steel bellows for positive squirm elimination, and complete with anti-torque device, limit stops, internal guides with female streamline ends.
 - .3 Anchors and guides in contact with copper pipe shall be copper, or copper-plated.
 - .4 Guides shall be FLEXONICS pipe alignment guides.

2.6 TRAP PRIMERS

- .1 Provide approved Zurn trap primers where noted on plans and/or as required by Plumbing Code, to maintain trap seals.

2.7 SHOCK ABSORBERS

- .1 Where shock absorbers are called for on water lines shall be Zurn Shoktrol sized in accordance with Plumbing and Drainage Institute standards.

2.8 CLEANOUTS

- .1 Cleanouts in cast iron soil pipe shall consist of cast iron ferrule with brass plug having raised head.
- .2 Cleanouts in copper drainage: Brass screwed plugs with raised head.
- .3 Cleanouts in cast iron screwed drainage fittings, (galvanized waste lines) shall consist of nipple and cap. Iron plugs not accepted. Exposed c.o. caps shall be chrome plated.

2.9 CLEANOUT ACCESS COVERS

- .1 Heavy traffic unfinished areas:
 - .1 Heavy duty cast iron cover and frame, with securing screws.
- .2 Finished and unfinished areas:
 - .1 Select cleanout access covers in areas having floor finish such as sheet vinyl tile, terrazzo, or carpet, to suit the finish. Cooperate with appropriate trades to apply finish to cleanout covers so they will be flush with floor, inconspicuous, and accessible. Floor cleanouts for sheet vinyl flooring shall be clamping type, Zurn ZZN-211R6-ST style, to properly seal (SVF) Sheet vinyl flooring to cover. Refer to architectural room finish schedules for locations.
 - .2 On special floor, rough-in properly to conform to adjacent flooring material as per manufacturer's installation instructions.
- .3 Cleanouts in walls to be located adjacent to access door, or to have a suitable finished access cover flush with wall so as to present a neat finished appearance and leave cleanout easily accessible.

2.10 PLUMBING FIXTURES AND EQUIPMENT

.1 General

- .1 Supply, install and connect up, complete, all plumbing fixtures shown on mechanical and architectural drawings. Be responsible for protection of all fixtures until building is accepted by the City.
- .2 All fixtures including trim shall be CSA approved, free from flaws or blemishes to approval of Contract Administrator. All finished surfaces shall be clear, smooth and bright, and guaranteed not to craze, discolour or scale. All fixtures shall be completely installed and connected to drain, vent, hot and cold water supply piping in approved manner.
- .3 Except as noted, all visible parts of trimmings of all fixtures, including faucets, shower heads, piping, escutcheons, wastes, strainers, traps, tail pieces, supplies, stops, etc. shall be heavily chrome-plated. This shall also apply to Work at all NIC equipment and fixtures in finished areas.
- .4 Except where specifically noted otherwise, supply and install screwdriver stop valve on hot and cold water supply to every fixture on project, in addition to valve or faucets on fixture itself.
- .5 Provide adequate supports for all fixtures. Have these built into walls with back-up plates where required.
- .6 Provide traps, and stops on supplies, for all fixtures and equipment.
- .7 Provide domestic water, vent and waste connections to all equipment requiring plumbing services. This shall include NIC items shown on architectural and mechanical drawings.
- .8 Provide shut-off valve on water supply connections at each piece of equipment.
- .9 Contractor shall confirm mounting heights for all fixtures before roughing in water, waste and vent piping.
- .10 Heating/Air-Conditioning Equipment:
 - .1 Connect water and drain to all heating and air-conditioning systems and equipment wherever noted in the specifications or on the drawings.
- .11 Miscellaneous Equipment:
 - .1 Rough-in and connect services as required to all items of equipment requiring same.
- .12 Silicone
- .13 Sealing of Fixtures:
 - .1 Silicone seal perimeter edges of fixtures as specified herein.
 - .2 Silicone to be mildew-resistant, translucent white silicone, General Electric Sanitary Silicone Sealant #SCS 1752.
 - .3 Section 22 10 01 shall provide silicone sealing of following fixtures: china drinking fountains, urinals, water closets, sinks (all types), and lavatories (china and enamelled steel).
 - .4 Application of sealant shall be by experienced applicators, regularly employed for sealant application.

- .5 Properly adjust and align fixtures prior to sealant application.
 - .6 Sealant bead to be smooth and neat, with proper proportions. Apply sealant in strict accordance with manufacturer published data.
 - .7 For wall hung fixtures, seal only 3 edges; top and both sides, not bottom.
 - .8 For china and enamel steel lavatories, seal perimeter edge between countertop and lavatory.
 - .9 Do not apply silicone sealant onto stainless steel fixtures.
 - .10 Unless noted otherwise, silicone sealing of tubs, shower stalls and shower bases to be responsibility of architectural division, under direction of Contractor.
- .2 Fixtures
- .1 See fixture schedule on drawings.
- .3 Equipment
- .1 See fixture schedule on drawings.
- 2.11 BACKFILL MATERIAL
- .1 Bedding and backfill material to 300mm (12") above the pipe shall conform to standard WCA 3 for granular fill.
 - .1 Passing ¾" 100%
 - .2 No. 4 80-90%
 - .3 No. 50 5-30%
 - .4 No. 200 0-5%
 - .2 Granular backfill material other than as described in .1 above shall conform to standard WCA 2.
 - .1 Passing 3" 100%
 - .2 No. 4 40-80%
 - .3 No. 200 5-20%
- PART 3 EXECUTION**
- 3.1 GENERAL INSTALLATION
- .1 Copper pipe shall not be buried except where specifically noted on drawings.
 - .2 All pipe shall be cut accurately to measurements taken at site, installed without springing or forcing. All changes in direction made with fittings.
 - .3 All connections to equipment made with unions or flanges.
 - .4 Remove valve working parts during installation to prevent damage from heat where brazing, soldering, or welding is used.
 - .5 Comply with latest CSA Standard W117.2 "Code for Safety in Welding and Cutting".
 - .6 Drain pipes dropping into slab on grade shall have expansion joint arranged to take up movement of slab.

- .7 Run all piping in accessible pipe spaces in such a way that it does not interfere with free access into pipe space.
 - .8 Co-operate with all sub-trades to properly locate all equipment connections.
 - .9 Provide a shutoff valve on supply connections at each piece of equipment.
- 3.2 DRAINAGE SYSTEMS
- .1 Sanitary Drains
 - .1 Provide complete systems of sanitary drainage and venting to serve all fixtures and equipment. This includes local drains from equipment such as fan units, pump bases, etc.
 - .2 Run building sanitary drain from connection point outside building as noted on drawings.
 - .3 All drainage piping to W.C.'s shall be 100mm (4") diameter minimum.
 - .4 Provide trap primers where noted on drawings. Connect to trap in an approved manner.
 - .5 Cleanouts:
 - .1 Install cleanouts at all changes of direction, at intervals of not over 15m (50') in horizontal runs, at all points where obstructions might be formed and at points required by plumbing regulations or shown on drawings.
 - .2 Cleanouts shall be accessible. Cleanouts above furred ceilings or in concrete slabs on grade shall be extended to floor level with cleanout access cover and frame.
 - .3 Cleanouts on sink waste and vent pipes shall have a chrome-plated cap installed tight to wall. Cleanouts behind walls shall have access panel. Cooperate in locating cleanouts adjacent to access panels, etc. All cleanout plugs lubricated/sealed with mixture of graphite and linseed oil or Teflon tape. Check all cleanouts immediately prior to turning the job over to the City. Remove plugs, re-lubricate with graphite and oil, and re-install using only enough force to insure permanent joint, depending on location.
 - .6 Flash vents through roof in approved manner. Drains on roofs shall be flashed or clamped to membrane water-proofing where required.
 - .2 Acid Drains
 - .1 General- provide acid drains where noted on plans to serve acid resisting floor drains, sinks, etc.
- 3.3 WATER SUPPLY SYSTEM
- .1 General
 - .1 Provide complete system of water supply piping to serve all fixtures, equipment, etc. This shall include cold water, hot water and hot water recirc. piping. Tempered water piping shall be considered to be hot water piping of water temperature is above 29 deg. C. (85 deg. F).
 - .2 Provide water meter to approval of Contract Administrator.
 - .3 Grade horizontal runs of piping to drain through risers.

- .4 Install drain valves with hose thread outlet at water meter, hot water tanks and in mains where shown and/or necessary for complete drainage.
- .5 Install shut off valves at water meter, hot water tanks and heaters, at all connections to major pieces of equipment, in all branches to fixtures or groups of fixtures.
- .6 Install dielectric insulating unions between all pipes of apparatus constructed of dis-similar metals. Use brass nipples at flush valves, etc.
- .7 Connect ends of all hot water risers to re-circulation main and continue this main back through recirculating pump. Recirculating piping shall be so arranged as to provide continuous and positive circulation of hot water throughout system at all times.
- .8 Each recirculating branch shall have balancing valve.

.2 Water Pipe Sizes to Fixtures

	<u>Cold</u>	<u>Hot</u>
Lavatory basins	13mm (1/2")	13mm (1/2")
Flush valves	25mm (1")	
Flush tanks	13mm (1/2")	13mm (1/2")
Sinks	13mm (1/2")	13mm (1/2")
Hose bibs	19mm (3/4")	19mm (3/4)
Drinking fountains	13mm (1/2")	
Showers	13mm (1/2")	13mm (1/2")

.3 Shock Absorbers

- .1 Supply and install shock absorbers on hot and cold water lines at each group of fixtures, each isolated fixture, and where noted on drawings. Sizes shall be as noted or in accordance with Plumbing and Drainage Institute Standard WH-201.
- .2 Where piping is concealed and not accessible provide air chambers one size larger than supply and 600mm (24") high.
- .3 Provide shock absorber upstream of every solenoid valve or quick closing valve. This applies also to NIC equipment having solenoid valves supplied by other divisions, such as washing machines, dishwashers, etc.
- .4 Review proposed location and type of shock absorbers with Contract Administrator prior to installation.

.4 Backflow Preventers

- .1 Provide approved backflow preventers on all potable water supplies as noted on drawings, specified herein, or as required by provincial/municipal authorities. (Conbraco, Watts)
- .2 Test backflow preventers in accordance with manufacturer's recommendations, Contract Administrator or as required by provincial/municipal authorities.

3.4 NATURAL GAS PIPING SYSTEM

- .1 Make arrangements with gas utility company to bring in service and install meter and regulator. Pay all service and installation charges.
- .2 Run piping as shown to serve equipment. Take out permits and connect equipment ready for use. Provide gas regulators as required. Run vent piping from relief valves to atmosphere. Install gas piping in accordance with Provincial

Department of Labour regulations. Provide gas cock at each piece of equipment. Provide drip pockets at each piece of equipment and at low points. Grade horizontal piping 1:500 (1" in 40') to drain through risers.

- .3 All natural gas piping concealed above lay-in tile ceilings, in walls or other inaccessible locations shall have all welded joints and shall be stamped by the welder with his number.
- .4 Where gas piping is welded, arrange with Provincial authorities to inspect and provide written approval to Contract Administrator prior to system use.

3.5 JOINTING

- .1 All joints shall be made in accordance with manufacturer's recommendations.
- .2 Asbestos cement and cast iron soil pipe shall be installed as recommended by manufacturer. Fittings shall be braced where necessary to prevent joints coming apart under pressure.
- .3 Cast iron hub and spigot soil pipe may be joined with oakum and lead, or Bibby Bi-Seal compression sleeve. Do not use oakum on hot water drain lines where suspended in finished area.
- .4 Screwed joints in steel piping shall be made with full cut standard taper pipe threads, with approved non-toxic joint compound applied to male threads only. Joint compound shall not be applied to the first thread. Avoid squeezing excess compound into pipes. All pipes must be reamed or filed and left full bore, clean and free of scale.
- .5 Joints in copper drainage and water tube shall be in strict accordance with manufacturer's published recommendations and as follows:
 - .1 Water tube up to and including 50mm (2") and drainage tube all sizes shall be lead free solder consisting of tin, copper, and silver (Silvabrite 100 or equal in accordance with B6).
 - .2 Water piping over 50mm (2") shall be brazed (Sil-Fos). Valve bonnets and inner parts must be removed from valve bodies when silver brazing valves and adjacent joints.
- .6 Where black steel pipe and welding fittings are specified or permitted, welding to be performed by welder holding current welder's certificate from Provincial Department of Labour.

3.6 EXPANSION AND CONTRACTION OF PIPING

- .1 Make provision for expansion and contraction of all piping. Use swing connections where shown or necessary.
- .2 Install hot water supply and recirculation piping with expansion loops where required and anchor by approved rigid anchors, in order to control expansion.
- .3 Install expansion joints where shown on drawings. Provide anchors and guides as recommended by manufacturer.

3.7 CLEANING AND FLUSHING

- .1 On completion, flush out piping systems before installation of equipment, fixtures, etc. in order to remove any foreign material in piping.
- .2 Clean out all plumbing fixtures and equipment and leave in first class operating condition.

3.8 TESTING

- .1 All piping systems shall be pressure tested as follows:
 - .1 Plumbing, drainage and natural gas systems- in accordance with local regulations.
 - .2 Water supply piping – test with water to 690 kpa (100 psig) at the highest point of system. Maintain pressure without loss for 4 hours.

PART 1 GENERAL

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 SCOPE OF WORK

- .1 Work to include all labour, material and equipment required for installing, testing and placing in initial operation the following systems as detailed in specifications of each section and as shown on drawings.

- .1 Section 23 05 00 Common Work Results - Mechanical
- .2 Section 23 07 12 Insulation
- .3 Section 22 10 01 Plumbing
- .4 Section 25 30 00 Controls
- .5 Section 23 05 93 Testing, Adjusting and Balancing
- .6 Section 23 54 11 HVAC System

1.3 EXISTING CONDITIONS

- .1 **Examine Site, existing adjacent buildings and local conditions affecting Work under this Contract. Examine Structural, Architectural, Mechanical and Electrical and all other Contract drawings to ensure Work can be performed without changes to the building as shown on plans. No allowance will be made later for necessary changes.**

1.4 REGULATIONS

- .1 Comply with, most stringent requirements of Manitoba Building Code, National Building Code and local regulations and by-laws, with specified standards and codes and this specification. Before any Work is proceeded with, approved layouts to be filed with and approved by proper authorities.
- .2 Provide necessary notices, obtain permits and pay all fees, in order that Work specified may be carried out. Charges and alterations required by authorized inspector of any authority having jurisdiction, to be carried out without charge or expense to the City of Winnipeg. Pay all charges for service connections to municipal mains.
- .3 Furnish certificates confirming Work installed conforms to requirements of authorities having jurisdiction.

1.5 LIABILITY

- .1 Install Work in advance of concrete pouring or similar Work. Provide and set pipe sleeves as required.
- .2 Install concealed pipes and ducts neatly, close to building structure so furring is minimum size. Pipes, ducts and equipment installed improperly, to be removed and replaced without cost to the City of Winnipeg.
- .3 Protect and maintain Work until building has been completed and accepted. Protect Work against damage during installation. Cover with tarpaulins if necessary. Repair all damage to floor and wall surfaces resulting from carrying out of Work, without expense to the City of Winnipeg.

- .4 During welding or soldering ensure structure is protected against fire, shield with fire-rated sheets and galvanized iron sheets. Mount portable fire extinguishers in welding or soldering areas. Notify Contract Administrator 24 hours prior to welding or soldering and receive approval to carry out such work.
 - .5 **Co-ordinate Work with other sections to avoid conflict and to ensure proper installation of all equipment. Review all Contract drawings.**
 - .6 On completion of Work, remove tools, surplus and waste material and leave Work in clean, perfect condition.
- 1.6 ENGINEERING OBSERVATIONS
- .1 Contractor's Work will be observed periodically by the City of Winnipeg, and/or Contract Administrator or their representatives, solely for the purpose of determining general quality of Work, and not for any other purpose. Guidance will be offered to the Contractor in interpretation of plans and specifications to assist him to carry out Work. Observations and directives given to the Contractor does not relieve the Contractor and his agents, servants and employees of their responsibility to erect and install Work in all its parts in a safe and workmanlike manner, and in accordance with plans and specifications, nor impose upon the City of Winnipeg and/or Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any Work.
- 1.7 WELDING REGULATIONS
- .1 Do not weld when temperature of base metal is lower than -17 degrees C except with consent of Contract Administrator. At temperature below 0 degrees C, surface of all areas within 75mm (3") of point where weld is to be started to be heated to temperature at least warm to hand before welding is commenced. At all temperatures below +4 degrees C, operator and Work to be protected against direct effect of wind and snow.
 - .2 Welding shall be performed by welder holding current welder's certificate from Provincial Department of Labour.
 - .3 Comply with CSA W117.2 "Safety in Welding, Cutting, and Allied Processes".
- 1.8 MECHANICAL SHOP DRAWINGS
- .1 Submit for review a minimum of six (6) sets of detailed shop drawings. Refer to Section 01 33 00
 - .2 **Check shop drawings for conformity to plans and specifications before submission.**
 - .3 **Each drawing to bear a signed stamp including project name and Contractor's Firm name verifying drawings have been checked prior to submission to Contract Administrator. Signature of stamp shall signify the Contractor has checked and found all dimensions to be compatible with the Contract drawings and all capacities, quantities, sizes and other data contained in the Contract documents have been listed by the supplier on the drawings and have been checked by the undersigned and found correct.**
 - .4 Clearly show division of responsibility. No item, equipment or description of Work shall be indicated to be supplied or Work to be done "By Other's or By Purchaser". Any item, equipment or description of Work shown on shop drawings shall form part of Contract, unless specifically noted to contrary.
 - .5 Take full responsibility for securing and verifying field dimensions. In case where fabrication must proceed prior to field dimensions being available, check all shop drawings and approve for dimensions only. In this case guarantee that dimensions will be

worked to and ensure that other Subcontractors are aware of these dimensions and shall comply to them.

- .6 Review by Contract Administrator shall be mutually understood to refer to general design only. If errors in detailed dimensions or interference with Work are noticed, attention of Contractor will be called to such errors of interferences, but Contract Administrator's review of drawings will not in any way relieve Contractor from responsibility for said errors or interferences, or from necessity of furnishing such Work, and materials as may be required for completion of Work as called for in Contract documents.

1.9 MECHANICAL SUBCONTRACTORS

- .1 In accordance with D12, state names of all Subcontractors to be used in sublet Work. Also, state extent of any Work so sublet. Request and receive Contract Administrator's approval in writing, of all Subcontractors for such Work before placing Subcontractor's Contract.
- .2 Contractor to have minimum five years experience in field of mechanical contracting and to have successfully performed Work of similar nature and approximate size to that indicated in specifications and on drawings. Subcontractor shall employ, on this project, foremen or supervisory personnel who have had similar experience to that required of Contractor.

1.10 DRAWINGS

- .1 Drawings are diagrammatic only and do not show all details. Information involving accurate measurements of building to be taken from Architectural Drawings and/or at building. Make, without additional expense to the City of Winnipeg, all necessary changes or additions to runs to accommodate structural conditions. Locations of pipes, ducts and other equipment to be altered without charge to the City of Winnipeg, provided change is made before installation and does not necessitate additional materials and that all such changes are ratified by Contract Administrator, recorded on Record Set of Drawings.
- .2 Drawings and specifications to be considered as an integral part of Contract Documents. Neither drawings nor specifications to be used alone. Misinterpretation of requirements of plans or specifications shall not relieve Contractor of responsibility of properly completing Work to approval of Contract Administrator.
- .3 As Work progresses and before installing piping, ductwork, fixtures and equipment interfering with interior treatment and use of building, consult Contract Administrator for comments. This applies to all levels and proper grading of piping. If Contractor fails to perform above checking and fails to inform Contract Administrator of such interference, Contractor to bear all subsequent expense to make good the installation.
- .4 Drawings indicate general location and route to be followed by pipes and ducts. Where required pipes and/or ducts are not shown on plans or only shown diagrammatically, install in such a way as to conserve head room and interfere as little as possible with free use or space through which they pass.
- .5 Refer to Architectural Drawings for roof construction details. These shall relate to roof supports, piping penetrating roofs, etc. as indicated on mechanical detail sheets.

1.11 MATERIALS

- .1 Materials and equipment specified and acceptable manufacturers are named in this specification for the purpose of establishing the standard of materials and workmanship to which Contractor shall adhere. Bid Submission shall be based on the use of materials and equipment as specified.

- .2 Materials of same general type to be of same manufacture (e.g. all air supply units shall be of same manufacturer). Contractor to ensure that all Subcontractors provide products of same manufacturer.
 - .1 Follow manufacturer's recommendations for safety, adequate access for inspection, maintenance and repairs of individual equipment installed.
 - .2 Permit equipment maintenance and disassembly with minimum disturbance to connecting piping and duct systems and without interference with building structure or other equipment.
 - .3 Provide accessible lubricating means for bearings, including permanent lubricated 'Lifetime' bearings.
 - .3 In accordance with B6, any substitutes or alternates the Contractor considers equal to that specified must not exceed available space limitations. All additional costs for mechanical, electrical, structural and/or architectural revisions required to incorporate materials substituted by Contractor shall be responsibility of Contractor.
 - .4 Equipment listed as 'equal' in specifications or submitted in accordance with B6 shall meet all space requirements, specified capacities and must have equipment characteristics of specified equipment as interpreted by Contract Administrator. Install equipment in strict accordance with manufacturer's published recommendations.
 - .5 Equipment and materials shown on drawings and not specified herein, or specified herein and not shown on drawings, shall be included in this Contract as though both shown and specified.
- 1.12 ELECTRIC MOTORS, STARTERS AND WIRING
- .1 Provide electric motors for all equipment supplied in this Division. Motors to operate at 29 r/s (1800 rpm), unless noted otherwise. Motor design shall comply with Canadian Electrical Code (latest edition) requirements. All electric motors supplied shall be capable of being serviced locally.
 - .2 Operating voltages: to CAN3-C235-83, motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
 - .3 Motors controlled by variable frequency drives (VFDs) shall comply with requirements of CSA Specification C22.2 No. 100-95, Clause 12.4 and shall be permanently marked with the following addition to the normal marking requirements:
 - .1 Machine Application (Inverter Duty).
 - .2 Speed range over which the machine is designed to operate.
 - .3 Type of torque application for which the machine is designed (e.g. VT (variable torque), CT (constant torque), Chp (constant horsepower) or equivalent.
 - .4 Type(s) of inverter(s) with which the machine is intended to be used e.g.: VSI or VVI (6-step voltage source), CSI (6-step current source), VPWM (voltage-source pulse width modulated), LCI (load commutated), cyclonverter, or equivalent.
 - .4 Motors 0.75 kW (1 hp) and larger shall be high efficiency motors as defined in CSA C390 or IEEE 112B Nominal Standards. Minimum efficiency (%) shall be per the following table.

Minimum efficiency (%)

kW	3600 RPM	1800 RPM	1200 RPM	900 RPM
.75	79.0	82.4	81.1	74.4
1.11	81.0	82.8	83.8	76.8
1.50	81.7	83.8	84.4	83.8
2.24	84.6	86.1	86.4	83.6
3.73	86.4	86.9	87.2	85.4
5.60	87.4	88.4	88.2	86.2
7.46	88.4	89.4	88.6	88.6
11.19	89.3	90.1	89.0	88.0
14.92	89.7	90.9	89.8	89.8
18.65	90.0	91.1	90.9	89.6
22.38	90.6	91.5	91.1	90.3
29.84	91.0	92.0	91.6	90.1

List information on shop drawing submittals.

- .5 Determine from electrical drawings and specifications, voltage characteristics applying to each individual motor. Where motor voltages are mentioned in this specification, confirmation to be made by reference to electrical drawings and specifications ordering motors.
 - .6 Division 26 – Electrical to provide starters for all motors, except as otherwise noted. Division 26 – Electrical shall wire from starters to motors.
 - .7 Wiring required between starters and switching apparatus such as wiring from starters to float switches, pressure switches and all control wiring to be by Division 26 Electrical except as noted otherwise on drawings and in specification. Provide proper terminal connections and lead wires at motors and other apparatus ready for connection by Division 26 – Electrical. Provide Division 26 – Electrical with accurate locations of electrical connection points and all necessary schematic and other drawings to facilitate electric Work.
 - .8 Wiring required under Section 25 30 00 – Instruments and Control Elements to be performed by Section 25 30 00 – Instruments and Control Elements except as noted otherwise. Refer also to Section 25 30 00 – Instruments and Control Elements for further requirements.
 - .9 Division 26 – Electrical to perform all wiring and make final connections to all controls for roof-top HVAC units and all mechanical equipment where controls are supplied with equipment.
 - .10 Division 23 shall provide wiring diagrams indicating all power and control wiring requirements.
 - .11 Division 26 – Electrical to perform all wiring and make final connections to all controls for air cooled condensing units. Refer to Clause “Refrigeration Piping and Accessories”.
 - .12 Division 23 shall provide wiring diagrams indicating all power and control wiring requirements for equipment supplied by Division 23.
- 1.13 IDENTIFICATION OF VALVES
- .1 Provide engraved lamacoid colour coded tags secured to items with non-ferrous chains or “S” hooks. Use for valves and operating controllers of all systems. Consecutively number valves in each piping system i.e. domestic water, steam, etc.
 - .2 For each building, provide tag schedule, designating number, service, function, colour code, and location of each tagged item.

- .3 Provide one plastic laminated copy and secure to mechanical room wall where instructed. Place one copy in each maintenance instruction manual.
 - .4 Identify controls and gauges by labels of 3mm (1/8") plastic engraving stock with white lettering on black background. Size approximately 62mm x 25mm (2½" x 1") high.
- 1.14 HANGERS AND SUPPORTS
- .1 General
 - .1 Piping, ductwork and equipment shall be securely supported from building structure. Perforated strap or wire hangers are not permitted.
 - .2 Support components shall conform to Manufacturers Standardization Society Specification.
 - .2 Installation – Horizontal
 - .1 Hangers shall adequately support piping system. Locate hangers near or at changes in piping direction and concentrated loads. Provide vertical adjustment to maintain pitch required for proper drainage. Allow for piping expansion and contraction. Piping weight and stresses shall be supported independently of any equipment.
 - .2 Maximum spacing between pipe supports:
 - .1 Steel Pipe: Up to 50mm (2") diam. – 2.4m (8 ft.) 62mm (2½") and larger – 3.6m (12 ft.).
 - .2 Copper Tubing (Hard): Up to 25mm (1") diam. – 1.8 (6 ft.) 32mm and larger – 2.4m (8 ft.)
 - .3 Cast Iron Pipe: Maximum spacing – in accordance with Plumbing Code. Locate hangers adjacent to hubs or joints. Support M.J. pipe on both sides of joint. Provide with sway braces and anchor to Contract Administrator's approval. At multiple fittings or short lengths provide sufficient hangers to support all joints to Contract Administrator's satisfaction.
 - .4 Plastic Pipe shall be supported as recommended by manufacturer.
 - .3 Installation – Vertical Piping
 - .1 Support vertical pipes at each floor by Anvil Fig. 261 riser clamps. Locate clamps immediately below coupling if possible. Support soil pipe at hub. Brace risers up to 50mm (2") size at intervals not over 2.13m (7"). Support base in approved manner.
 - .4 Structural Attachments
 - .1 To Concrete:
 - .1 Place inserts in structural floors for support of piping and equipment prior to pouring of concrete. Inserts in concrete slabs shall be Anvil Fig. 285 Light Weight Concrete Insert for loads up to 182 Kg (400#) or Anvil Fig. 281 Wedge type concrete insert for loads up to 544 Kg (1200#).
 - .2 Support hangers in corrugated steel deck by 50mm (2") piece of 3mm (1/8") thick steel plate placed across top of steel deck, secured to hanger rod by washer and nut; prior to pouring of concrete topping.

- .3 Where inserts must be placed in existing concrete use Hilti H.D.I. steel anchors as recommended by manufacturer, or if heavy weights must be supported, drill hole through slab and provide 50mm x 50mm (2" x 2") washer and nut above rough slab before floor finish is poured.
- .2 To Steel Beams:
 - .1 Where pipe size is 50mm (2") or less, use Anvil Fig. 87 Malleable Iron C-Clamp and Retaining Clip, or equal in accordance with B6.
 - .2 Where pipe size is over 50mm (2"), use Anvil Fig. 229 Malleable Beam Clamp or Fig. 228 Forged Steel Beam Clamp, or equal in accordance with B6.
- .3 Miscellaneous:
 - .1 Provide suitable attachments equal or better in quality to above where required.
- .5 Hangers and Supports
 - .1 Steel Pipe: Up to 50mm (2") – Anvil Fig. 65 light clevis – size to suit O.D. of pipe. 62mm (2 1/2") and larger – Fig. 260 clevis – size to suit O.D. of insulation.
 - .2 Copper Tubing (Hard):
 - .1 Up to 50mm (2") – Anvil CT65 copper plated clevis – size to suit O.D. of pipe. Fig. 65 may be used if isolation is provided – see below.
 - .2 62mm (2 1/2") and larger – Fig. 260 clevis – size to suit O.D. of insulation – on uninsulated pipe provide isolation as specified below.
 - .3 Cast Iron Pipe:
 - .1 All sizes – Fig. 260 clevis – size to suit O.D. of pipe.
 - .4 Plastic and Other Types of Piping: Support as recommended by manufacturer.
 - .5 Provide fabricated steel supports as detailed on drawings or as required to adequately support piping and equipment. Details to be approved by Contract Administrator. Supports shall be of welded construction except where adjustment is required.
 - .6 Where thermal expansion in excess of 12mm (1/2") axially is anticipated, or where indicated, use Anvil Fig. 171 Adjustable Pipe Roll or Anvil Fig. 271 Pipe Roll Stand.
 - .7 For vertical piping support, use Anvil Fig. 261 clamp. For vertical copper piping, use Fig. CT-121-C.
 - .8 Above indicates general requirements. Provide hangers and supports of equal quality to suit job requirements where not covered by the above.
 - .9 Support groups of horizontal pipes by angle iron trapeze hangers.
 - .10 Rollers and chairs shall not be installed on trapeze hangers.
 - .11 Several individual hanger rods may be supported from a trapeze or individual inserts in concrete slab.
 - .12 Hangers to be adjustable after pipe is in place. Parts must be of adequate strength for weight to be supported with safety factor of 5 to 1.

- .13 Hangar Rod:
 - .1 Support hangers with mild steel rod. Load on hanger not to exceed capacity indicated in following table:
 - .2 Rod Diam. Max. Safe Load
 - 9.5mm (3/8") 277 Kg (610 lbs.)
 - 13mm (1/2") 514 Kg (1130 lbs.)
 - 16mm (5/8") 822 Kg (1818 lbs.)
 - 19mm (3/4") 1232 Kg (2710 lbs.)
 - .3 Rods to have sufficient threaded length to allow for vertical adjustment after pipe is in place. Use two nuts in each rod, one above clevis or angle iron, and one below.
- .6 Isolation
 - .1 Copper piping shall be isolated from steel supports by copper plated hangers, plastic coated hangers, tinning pipe at supports, or provision of suitable lead or copper isolators.
- .7 Protection Saddles
 - .1 On piping 50mm (2") and smaller, carry insulation over pipe hangers. Canvas jacket shall be neatly cut and formed to fit over hangers. On chilled and cold water piping, insert sections of insulation into space above pipe at each hanger. Seal saddle and pipe with insulation.
 - .2 On insulated steel pipe over 50mm (2") diameter, use at each hanger or support, Anvil Fig. 160, 161 or 162 to suit pipe size and insulation thickness. Pack space between saddle and pipe with insulation.
 - .3 On copper piping over 50mm (2") diameter, use at each hanger or support Anvil Fig. 167 protection shield or approved equal in accordance with B6. Shields shall have minimum length of 300mm (12") to spread weight.
- 1.15 SUPPORTS, BASES, PITS
 - .1 Supply and erect all special structural Work required for installation of tanks, pumps, fans, motors and other apparatus.
 - .2 Concrete pads, concrete for floating bases, curbs and pits to be supplied under Division 3. Supply all anchor bolts, fasteners and foundation drawings. Unless noted otherwise, all major pieces of equipment such as pumps, compressors, fans, etc. to be mounted on 150mm (6") concrete pad. Refer to standard details for method of forming pump bases, etc.
 - .3 Mount equipment suspended above floor level but not detailed on platform bracketed from wall. Where wall thickness is inadequate to permit such brackets, carry supports to either ceiling or floor, or both as required.
 - .4 Fire hose cabinets to be complete with suitable bases or mounting brackets. Where shown on or in walls, angle or channel iron supports to be installed to bear equipment.
- 1.16 FLASHING
 - .1 Where pipes or ducts go through a roof or wall, they should be boxed-in and flashed as per Division 3. Allow for expansion and contraction of pipe. Flashing shall be waterproof.

1.17 ACCESS DOORS

- .1 Division 23 – Mechanical, Subcontractor to provide access doors where valves, dampers and/or any other mechanical equipment requiring access are built-in.
- .2 In general terms, Mechanical Subcontractor responsible for supplying the valve, dampers, etc. shall provide the access door required to get to the valve, damper, etc.
- .3 Access door to be 2.5mm (12 ga.) steel, 300mm x 450mm (12" x 18") or as specified elsewhere, finished prime coat only, with concealed hinges, anchor straps, plaster lock and without screws, all equal to Milcor manufacture. Where it is necessary for persons to enter through door, doors to be at least 450mm x 600mm (18" x 24") or as required.
- .4 In applied tile or exposed glaze or unglazed structural tile, access doors shall take place of the tiles and be sized and located to suit tile patterns. In plaster ceilings, doors shall take the plaster. In masonry walls access doors to be sized and located to suit masonry unit sizes. In lay-in acoustic tile ceilings, no access doors are required, but install an approved coloured marking device in the ceiling tile below all points requiring access. Refer to Architectural Room Finish Schedule and details on architectural drawings.
- .5 Supply access doors for concealed valves or groups of valves, dampers, fire dampers, flush valves, shock arrestors, trap seal primers, etc.
- .6 Access doors located in fire rated ceilings and walls shall be an approved ULC stamped, fire rated door.

1.18 IDENTIFICATION OF EQUIPMENT

- .1 Provide manufacturer's nameplate on each piece of equipment.
- .2 In addition Mechanical Subcontractor shall provide equipment I.D. tag minimum size 87mm x 32mm x 2.3mm (3 1/2" x 1 1/2" x 3/32") nominal thickness laminated phenolic plastic with black face and white centre. Engraved 6mm (1/4") high lettering. For motors and controls and for larger equipment such as chillers, tanks, 25mm (1") high lettering; for hot equipment such as boilers and convertors, provide engraved brass or bronze plates with black paint filled identification.
- .3 Identify as follows: equipment type and number (e.g. pump no. 2), service or areas or zone building served (e.g. south zone chilled water primary).
- .4 Provide manufacturer's registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval plates) as required by respective agency and as specified.

1.19 FLOOR PLATES AND SLEEVES

- .1 Set sleeves in concrete forms for all pipes and ducts passing through concrete walls, beams and slabs.
- .2 Pipe sleeves to extend above floor line as follows:
 - .1 Unfinished areas – 25mm (1")
 - .2 Finished areas (copper sleeves) – 6mm (1/4")
 - .3 Mechanical rooms, kitchens and washrooms – 100mm (4")
 - .4 Caulk sleeves to provide watertight installation

- .3 Where pipes pass through floors and walls in finished areas and where exposed to view, provide Crane #10 B.C. chrome-plated pressed floor plates, or approved equal in accordance with B6.
 - .4 Sleeves and holes for cold water, chilled water and ice water lines to be large enough to accommodate pipe insulation. Insulation on hot water lines may stop at walls or floors.
 - .5 Prior to installing sleeves in concrete beams, receive final jobsite approval by the Contract Administrator.
- 1.20 MECHANICAL EQUIPMENT GUARDS
- .1 Meet safety requirement of Provincial Department of Labour and local authorities having jurisdiction.
- 1.21 SCREWS, BOLTS AND FASTENERS
- .1 Use standard commercial sizes and patterns with material and finish suitable for service.
 - .2 Use heavy hex heads, semi-finished unless otherwise specified. Use non-ferrous material throughout for plumbing services. Use type 304 stainless steel for exterior areas.
 - .3 Bolts used on fan equipment for access to motors, bearings, filters and the like shall be heavy-duty.
 - .4 Bolts shall not project more than one diameter beyond nuts.
 - .5 Washers
 - .1 Use plain-type washers on equipment, sheet metal and soft gaskets, lock-type washers where vibration occurs, and resilient washers with stainless steel.
- 1.22 SPECIAL TOOLS AND SPARE PARTS
- .1 Furnish the City of Winnipeg with spare parts as follows:
 - .1 One set of pump seals, packing for each pump
 - .2 One casing joint gasket for each size pump
 - .3 One set of v-belts for each piece of machinery
 - .4 One set of filters for each filter bank installed
 - .5 One spare cartridge for each thermostatic mixing valve
 - .2 Identify spare parts containers as to contents and replacement parts number.
 - .3 Provide one set of all specialized tools required to service equipment as recommended by manufacturers.
- 1.23 PUMPS- GENERAL
- .1 Provide coupling guards on all pumps.
 - .2 Submit certified pump curves with shop drawings. Pumps shall be selected such that head at design conditions does not exceed 85% of maximum possible head at design flow rate.
 - .3 Manufacturer to include for checking and aligning pumps prior to start-up. Following completion of piping all base mounted pumps shall be aligned by a qualified millwright using a dial gauge. Alignment using a straightedge is not acceptable as it does not provide sufficient accuracy. The millwright shall provide a report indicating the degree of misalignment prior to carrying out the Work and the final readings when the alignment

Work has been completed. Final payment will not be made until a satisfactory report has been submitted.

- .4 Piping adjacent to pump to be supported from structure so no weight is carried on pump casings. Use long sweep elbows at pump.
 - .5 All pumps to have motor size large enough to not overload at runout condition. If this requires larger motor than specified, pay for larger motor starter, wiring and the like.
 - .6 Provide mechanical seals on all pumps.
- 1.24 OPENINGS IN FIRE SEPARATIONS
- .1 Provide firestopping for all openings in fire separations for passage of pipes, ducts, etc. to maintain integrity of fire separations.
 - .2 Firestopping
 - .1 Firestopping to be Dow-Corning Fire Stop System, or approved equal in accordance with B6.
 - .2 Material shall be Dow-Corning silicone elastomer Fire Stop penetration Seal and/or Dow-Corning liquid silicone elastomer Fire Stop Foam of density, width and depth to maintain assembly fire resistive rating, or approved equal in accordance with B6.
 - .3 Components shall be ULC listed.
 - .3 Installation
 - .1 Prepare all surfaces so they are clean, dry and frost free, as per manufacturer's published recommendations.
 - .2 Use Sealant around single pipes and/or ducts.
 - .3 Use Foam for multiple pipe installation.
 - .4 Follow manufacturer's published installation instructions precisely including field quality control after installation.
 - .5 Submit to Contract Administrator, suitable document signed by manufacturer's local representative, stating:
 - .1 Div. 23 Subcontractor received sufficient installation instruction from manufacturer's representative.
 - .6 **Remove firestopping assembly for random inspection by Contract Administrator and replace at no extra cost to the City of Winnipeg.**
- 1.25 TRIAL USAGE
- .1 The City of Winnipeg reserves right to use any piece of mechanical equipment, device or material installed under this Contract, for such reasonable lengths of time and at such times as Contract Administrator may require, to make a complete and thorough test of same, before final completion and acceptance of any part of Contract. It is agreed and understood, that no claim for damage will be made for any injury or breakage to any part or parts of the above due to aforementioned tests, whether caused by weakness or inaccuracy of parts, or by defective materials or workmanship of any kind whatsoever. Supply all labour and equipment for such tests.
- 1.26 SAFETY DEVICE TESTING
- .1 Make complete inspection of all safety devices to ensure:

- .1 That safety devices are complete and in accordance with specifications and manufacturer's recommendations.
 - .2 That the safety devices are connected and operating according to all local regulations.
 - .2 Safety devices to be inspected shall include, but not be limited to:
 - .1 Pressure relief valves.
 - .2 Freeze protection devices.
 - .3 Fire dampers.
 - .4 Ceiling fire stops.
 - .3 **On completion of inspections, supply to Contract Administrator letters and/or certificates for their record, confirming that inspections have been completed.**
- 1.27 TEMPORARY USE OF EQUIPMENT
- .1 Permanent systems and/or equipment not to be used during construction period, without Contract Administrator's written permission.
 - .2 Heating systems may be used for temporary heating within limitations specified under Clause 'Temporary Heating'. Refer also to 'General Conditions'.
 - .3 Equipment used during construction period to be thoroughly cleaned and overhauled. Replace worn or damaged parts so equipment is in perfect condition, to entire satisfaction of Contract Administrator and the City of Winnipeg.
 - .4 Provide proper care, attention and maintenance for equipment while it is being used. If, in the opinion of Contract Administrator, sufficient care and maintenance is not being given to equipment and systems, Contract Administrator reserves right to forbid further use of said equipment and systems.
 - .5 Temporary use of equipment shall in no way relieve Contractor of providing twelve month guarantee on all equipment so used. This guarantee period to commence as of date of final acceptance of building by the City of Winnipeg as interpreted by Contract Administrator.
 - .6 All air filters shall have bi-monthly inspection. Filters shall be cleaned and/or replaced depending on filter type during period in which ventilation units are being used for temporary heat and/or commissioning of system. Contractor to be responsible for and pay all costs for air filter cleaning service. Filters to operate between pressure drops noted in filter manufacturer's catalogue.
- 1.28 RECORD DRAWINGS
- .1 Provide one set of Contract prints to form Record Drawings, marked clearly in red pencil with all changes and deviations from piping and ductwork, including all Contract Changes.
 - .2 Update Record drawings on a regular basis to ensure they are accurate.
 - .3 This information will be used by others to create Record Drawings on CAD.
- 1.29 INSTRUCTIONS TO THE CITY OF WINNIPEG'S PERSONNEL
- .1 In addition to start-up supervision and instruction of the City of Winnipeg's personnel required of individual equipment manufacturers and systems as noted, Contractor's construction supervisor to instruct the City of Winnipeg's personnel in operation and maintenance of all equipment and systems to satisfaction of Contract Administrator.

- .2 Provide the City of Winnipeg with four copies of manuals incorporating following:
 - .1 Service instructions – including lists of spare and replacement parts and names and addresses of suppliers.
 - .2 Maintenance and Operating instructions.
 - .3 Revised shop drawings.
- .3 Forward manuals to Contract Administrator for review. Final payment will not be made until all required manuals have been received.
- .4 Review instructions with the City of Winnipeg’s representative to ensure the City of Winnipeg’s representative has a thorough understanding of equipment and its operation.
- .5 Contractor shall submit to Contract Administrator, suitable document signed by the City of Winnipeg’s representative, stating:
 - .1 The City of Winnipeg has received satisfactory instruction in operation and maintenance of all equipment and systems.
 - .2 Operation and maintenance manuals have been reviewed with the City of Winnipeg.
 - .3 Specified spare parts, keys, removable handles and the like, have been turned over to the City of Winnipeg.

1.30 TEMPORARY HEATING

- .1 Obtain written permission from Contract Administrator to use permanent heating system for temporary heat. Operate systems in strict accordance with equipment manufacturer and Contract Administrator’s recommendations.

1.31 PAINTING

- .1 Finish painting of mechanical equipment, piping and the like, to be performed by Section 09 91 10 – Painting.
 - .1 Co-operate with Section 09 91 10 – Painting in identifying equipment and piping where required for colour coding, pipe stencilling and the like.

1.32 IDENTIFICATION OF PIPING

- .1 Division 23 shall provide mechanical pipe identification with exception that Section 09 91 10 – Painting shall provide Primary Colour painting for identification.
- .2 Identify fluids in piping with showing name and service, including temperature and pressure where relevant, and to indicate flow direction.
- .3 Apply primary colours in exposed areas only on finished piping surfaces, including secondary colour bands, to indicate type and degree of hazard.
- .4 For building additions and alterations, use existing coding system. For new building, use CGSB 24-GP-3a and CSA and B53 colour codings and identification systems, using CGSB 1-GP-12c colour coding system schedule.

.1	<u>Primary Classification</u>	<u>Secondary Classification</u>	<u>Legend and Direction Arrows</u>
	Yellow 505-101	Orange 508-102	Yellow
	Green 503-107	Purple 511-101	Black 512-101
	Blue 202-101	Black 512-101	White 513-101
	Red 505-102	Yellow 505-101	
	White 513-101		

- .5 Pipe Markers and Secondary Colour Bands
 - .1 Plastic coated cloth material with protective overcoating on outside and waterproof contact adhesive on underside, suitable for continuous operating temperature of 149 deg. C (300 deg. F) and intermittent temperature of 204 deg. C (400 deg. F).
 - .2 For secondary colour bands apply 50mm (2") wide tape single wrap around pipe or pipe covering with ends overlapping 25mm (1") minimum.
 - .3 Use block capital letters 50mm (2") high for pipes of 75mm (3") or larger od (including insulation) and not less than 18mm (3/4") high for smaller diameters.
 - .4 Use direction arrows 150mm (6") long by 50mm (2") wide for piping of 75mm (3") or larger od including insulation and 100mm (4") long by 18mm (3/4") wide for smaller diameters. Use double head arrows where direction of flow is reversible.
 - .5 Use waterproof and heat resistant plastic marker tags for pipes and tubing of 18mm (3/4") and smaller od.
 - .6 Use black pipe marker letter and direction arrows except use white on red background for protection piping.
- .6 Standard of Acceptance: WH Brady identification tapes, bands, markers.
- .7 Location of Identification
 - .1 Locate markers and classifying colours on piping systems, so that they can be seen from floor or platform.
 - .2 Identify piping runs at least once in each room.
- .8 Legends and colour classifications: Submit to Contract Administrator for approval, where differing from following table, at least two weeks before ordering material.
- .9 Table: Pipe and valve identification. Note: Information in brackets under Pipe Marker Legend column is explanatory and need not be included as part of legend test.

<u>PIPE MARKER LEGEND</u>	<u>VALVE TAG LEGEND</u>	<u>PRIMARY COLOUR</u>	<u>SECONDARY COLOUR</u>
Natural gas	N.G.	Yellow	Orange
Hot water heating supply (up to 121 C - 250 F)	H.W.H.S.	Yellow	Black
Hot water heating return (up to 121 C – 250 F)	H.W.H.R.	Yellow	Black
City water	CI.W.	Green	None
Cold water	C.W.	Green	None
Dom hot water supply	D.H.W.S.	Green	None
Dom hot water recirc	D.H.W.R.	Green	None
Make-up water	M.U.W.	Yellow	Black
Storm sewer	S.S.	Green	None
San sewer	SAN.S	Green	None
Comb san storm sewer	C.S.S.S.	Green	None
Refrigerant suction (include refrigerant no.)	REF.S. (N.O.)	Yellow	Black
Sprinkler water	S.W.	Red	White
Vent (plumbing)	V.P.	Green	None
Vent	V.	Yellow	Black

1.33 IDENTIFICATION OF DUCTWORK

- .1 Use black 50mm (2") high stencilled letters (e.g. "Cold", "Hot", "Return", "Sanitary Exhaust", "Kitchen Exhaust") with arrow indicating air flow direction.
- .2 Distance between markings 15m (50') maximum.
- .3 Identify ducts on each side of dividing walls or partitions and beside each access door.
- .4 Stencil only over final finish.
- .5 Prior to installation, review general application of identification with Contract Administrator.

1.34 CUTTING AND PATCHING

- .1 Refer to Section 01 61 00.
 - .1 Section 23 shall mark all openings required for pipes, ducts, grilles and the like.
 - .2 Cutting to be 'neat' sizes. Patch all edges so grille frames hide cut edges.

1.35 SALVAGE

- .1 N/A

1.36 CLEANING AND FLUSHING OF PIPING SYSTEMS

- .1 On completion, each piping system shall be flushed out before installation of equipment, fixtures, etc. in order to remove any foreign material in piping.
- .2 Flush with water, unless noted otherwise in individual mechanical sections of specifications.
- .3 All plumbing fixtures and all equipment shall be thoroughly cleaned and left in first class operating condition.

PART 1 GENERAL

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.
- .2 Testing, Adjusting and Balancing (TAB) Agency shall be an experienced, independent Contractor specializing in the testing, adjusting and balancing of HVAC systems.
- .3 Include extended service for 90 days after completion of final balancing Work, during which time Contract Administrator at his discretion may request re-check or re-setting of any systems an/or equipment listed in test report.

1.2 SCOPE OF WORK

- .1 Provide complete testing, adjustment and final balancing of all building air systems.
- .2 Provide inspection, verification and testing of all fire dampers, fire/smoke dampers, smoke control dampers and ceiling fire stops after installation. Coordinate the Work with Sections 23 54 11 and 25 30 00.

1.3 REFERENCES

- .1 AABC – National Standards for Total System Balance.
- .2 ADC – Test Code for Grilles, Registers, and Diffusers.
- .3 ASHRAE 111 – Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- .4 NEBB – Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.
- .5 SMACNA – HVAC Systems Testing, Adjusting and Balancing.

PART 2 PRODUCTS

2.1 BALANCING REPORTS

- .1 Provide two copies of detailed draft balancing report to Contract Administrator for review after completion of all adjustments.
- .2 Final balancing report shall incorporate all changes resulting from Contract Administrator's comments and any adjustments undertaken since the draft report was issued.
- .3 Provide four copies of final balancing report.
- .4 Provide sufficient number of copies of final balancing report to Mechanical Subtrade for inclusion in Operating & Maintenance Manuals.

PART 3 EXECUTION

3.1 GENERAL

- .1 All instruments used shall be accurately calibrated and maintained in good working order. If requested, tests shall be conducted in the presence of Contract Administrator and/or his representative. Provide 48 hrs. notice prior to start of Testing, Adjusting and Balancing.
- .2 Schedule all Work to comply with completion date.

- .3 Work shall not begin until system has been completed and in full working order. Division 23 shall put all heating, ventilating, and air-conditioning systems and equipment into full operation, as season would demand, and shall continue operation of same during each working day of testing, adjusting and balancing.

3.2 AIR BALANCING

- .1 Coordinate with Section 23 54 11 to ensure installation of all manual adjusting dampers and pitot tube enclosures are as indicated, as specified and as required to allow proper adjustment of air systems.
- .2 Testing Procedure
 - .1 Test, adjust and record all fan speeds, motor amperes.
 - .2 Make pitot tube traverse to main supply and obtain cfm at fan.
 - .3 Test and record static pressure for each system at fan suction and discharge.
 - .4 Adjust all supply and return air ducts to proper design cfm.
 - .5 Test and adjust each diffuser, grille, and register to within 5% of design requirements. Balance as per manufacturer's recommendations.
 - .6 All outlets shall be adjusted to provide proper throw and distribution, in accordance with architectural requirements.
 - .7 Fan operating conditions tested shall confirm air delivery within 5% of manufacturer's fan curves.
 - .8 System shall be balanced so that fans operate at lowest possible static pressure.
 - .9 Prepare single line diagrams of duct systems indicating terminal outlets identified by number. List on data sheets all such outlets denoted by the same numbers, including the outlet sizes, 'K' factor, location, cubic feet per minute and jet velocity. Provide this data for all supply, return and exhaust air systems.
- .3 As part of Work of this Contract, Section 23 54 11 shall make any changes in units set points, and any additional manual dampers for correct balance as recommended by Section 23 05 93, at no additional cost to the City. Section 23 05 93 shall provide final adjustment of equipment set points.

3.3 SYSTEM CHECK

- .1 Provide spot checks of systems if called upon by Contract Administrator. If capacities, fan speeds, ratings, etc. do not agree with submitted balance report, rebalance system or systems in question, until satisfactory results are received.

3.4 TESTING/VERIFICATION OF FIRE PROTECTION EQUIPMENT

- .1 Section 23 05 93 shall test and verify operation all new and/or relocated fire dampers, combination fire/smoke dampers, ceiling fire stops and smoke control dampers on this Project. Coordinate Work with Section 23 54 11.
- .2 Testing shall be performed after air balancing has been completed.
- .3 Test shall include following:
 - .1 Visual inspections of each device:
 - .1 Confirm appropriately rated device installed and CSA/ULC label affixed and visible through duct/ceiling access door.

- .2 Confirm appropriate duct and/or ceiling access door provided to permit servicing of device. Confirm duct access door open-able without interference from adjacent ceiling, pipes, ducts, etc.
- .3 Confirm device has been installed in accordance with requirements of the specifications, manufacturer's instructions and codes.
- .4 Confirm proper installation, clearances, use of proper angle framing, use of proper fasteners, use of fire rated material in wall opening, location of breakaway joints, etc.
- .5 Confirm that device has not been painted.
- .2 Operational inspection of each device to include:
 - .1 Manual release of fusible link allowing device to close. Confirm tight fit closure without binding.
 - .2 Confirm that appropriate fusible link is installed.
 - .3 Re-open device and reset fusible link connection.
- .3 Following requirements are in addition to the above noted testing requirements and shall apply to all motorized smoke and fire/smoke dampers, including all motorized dampers associated with smoke control systems.
 - .1 Associated fan system shall be operating as per normal conditions.
 - .2 Power to operator shall be applied/removed, as required to cause damper to open. Ensure full opening operation without binding or overdriving of operator.
 - .3 Power to operator shall be removed/restored, as opening operation without binding or overdriving of operator.
 - .4 Ensure damper closes/opens against associated fan operating static pressure.
 - .5 Ensure proper adjustment of all damper drive linkages for fully open and fully closed positions and operation through full range without binding.
 - .6 Ensure proper device configuration e.g. power-to-open or power-to-close as specified.
- .4 Coordinate Work with Sections 23 54 11 and 25 30 00. Instruct Sections 23 54 11 and 23 05 93 as appropriate to repair or replace, as required, all devices or components of devices identified as being faulty, and to correct any installation deficiencies noted.
- .5 After necessary repairs have been completed, Section 25 30 00 shall re-inspect/retest each device as indicated above.
- .6 Provide verification report on completion of Work. Report shall indicate general location (e.g. room number or description) and specific location (e.g. north wall above ceiling) of access door to device. Report shall include itemized verification of following, as appropriate, for each device.
 - .1 Device is fully accessible.
 - .2 Device has been properly installed.
 - .3 Device has been successfully tested.
 - .4 Device has been reset.

.5 Name of tester.

.6 Date device tested successfully.

3.5 IDENTIFICATION OF FIRE DAMPERS AND CEILING FIRE STOPS

- .1 At all fire dampers, fire/smoke dampers, smoke control dampers and ceiling fire stops, supply and install identification tags. Tags c/w envelopes shall be of type approved by Contract Administrator.
- .2 Envelopes shall be mechanically fastened to adjacent duct access door, or onto structure near dampers or ceiling fire stop where there is no connecting ductwork.
- .3 After each device has been verified as noted above, Section 23 05 93 shall label tag with permanent ink identifying device, location (room number), inspection date, inspector's signature and TAB Agency name.

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 All drawings and all sections of the specification shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

- .1 Labour, material, plant, tools, equipment and services necessary and reasonably incidental to completion of external insulation for mechanical equipment, piping, ductwork.

1.3 REFERENCES

- .1 NAIMA National Insulation Standards
- .2 SMACNA – HVAC Duct Construction Standards – Metal and Flexible

1.4 RELATED WORK

- .1 Common Work Results - Mechanical Section 23 05 00
- .2 Plumbing Section 22 10 01
- .3 HVAC System Section 23 54 11

PART 2 PRODUCTS

2.1 MATERIALS

- .1 All materials shall be equivalent in all respects to specified products and shall be used only in applications intended by the manufacturer. Materials not specifically intended for the purpose shall not be used. Approved materials shall not be diluted or blended with other materials unless specifically recommended by the manufacturer of the approved material.
- .2 All final pipe and duct installations including insulation, covering and adhesive shall have a ULC Certified flame spread rating of not greater than 25, and a smoke developed classification of not more than 50.
- .3 All canvas shall be treated to be fire retardant in accordance with ULC standards
- .4 Wire to be 1.2mm (18 ga.) stainless steel, dead soft annealed, type 304.

2.2 COMPATIBILITY OF COMPONENTS

- .1 All adhesives, sealers, vapour coating, mastics, laggings and bedding compounds, shall be compatible with materials to which they are applied. They shall not soften, corrode, or otherwise attack such material in either wet or dry state and shall only be those recommended by manufacturer of insulation as suitable for application proposed. They shall be applied at ambient conditions acceptable to the manufacturer.

2.3 COLD INSULATION – PLUMBING

- .1 Material
 - .1 On pipes 50mm (2") diameter and under, use 12mm (1/2") Fiberglas 112 kg/m³ (7 lb./cu. ft.) density pipe insulation with ASJ jacket. 13mm (1/2") Armstrong Armaflex AP or Rubatex equal may be used for domestic cold water and cooling coil condensate drains piping only.

- .2 On pipes 62mm (2 ½") diameter and larger, use 25mm (1") Fibreglas 88 kg/m³ (5 ½" lb./cu. ft.) density pipe insulation with ASJ jacket, complete with vapor barrier.
- .3 Vent piping in cold attics shall be less vapor barrier jacket and wired on.
- .2 Location
 - .1 All domestic cold water piping.
 - .2 All cooling coil condensate drains.
 - .3 Roof hoppers, vertical and horizontal storm drains except in crawlspaces.
 - .4 Vent piping for a developed length of 3m (10' – 0') from roof terminals.
 - .5 Vent piping located in cold attics and in other cold locations.
 - .6 Sump pump discharge lines that pass through ceiling spaces.
 - .7 Water meters.
 - .8 Run outs from mixing valves to shower heads.
- 2.4 HOT INSULATION – PLUMBING
 - .1 Material
 - .1 Fibreglas insulation with all service jacket (ASJ) and self seal lagging adhesive.
 - .2 On pipes 50mm (2") diameter and under, use 25mm (1") Fibreglass 112 kg/m³ (7 lb./cu. ft.) density insulation.
 - .3 On pipes 62mm (2 ½") diameter and larger, use 38mm (1 ½") Fibreglas 88 kg/m³ (5 ½ lb./cu. ft.) density insulation.
 - .2 Location
 - .1 All domestic hot water, and tempered water supply and hot water recirculation piping.
- 2.5 HOT INSULATION – HEATING
 - .1 Materials
 - .1 On piping 50mm (2") diameter and under, use 25 (1") Fibreglas 88 kg/m³ (5 ½ lb./cu. ft.) density pipe insulation with ASJ (all service jacket) and self seal lagging adhesive.
 - .2 On piping 62mm (2 ½") diameter and larger, use 37mm (1 ½") Fibreglas 88 kg/m³ with ASJ.
 - .2 Location
 - .1 All new hot water heating supply and return piping, including accessory apparatus such as air eliminators and the like.
- 2.6 WHITE PVC INSULATION COVER
 - .1 Cover insulation and insulated fittings with white PVC fitting covers.
 - .2 The fitting cover system shall consist of one-piece pre-molded high impact PVC fitting covers with fiber glass inserts and accessories, including elbows, tee-valves, end caps, mechanical line couplings, specialty fittings, jacketing, tacks, and PVC tape.

- .3 Cover shall have a flame spread rating of not more than 25 and a smoke developed classification of not more than 50.
 - .4 Cover shall be resistant to and not promote growth of fungi or bacteria.
 - .5 Cover shall be UV resistant for use indoors or outdoors. Paint outdoor fittings for further UV and colorfast protection.
 - .6 Locations
 - .1 All exposed piping and storage rooms.
- 2.7 VAPOUR BARRIER FLEXIBLE DUCT INSULATION
- .1 The following duct shall be externally insulated with Fibreglas RFFRK reinforced foil-faced vapour seal duct insulation PF335, 340 g. (3/4 lb./cu. ft.) density.
 - .1 25mm (1") Thickness
 - .1 All round supply air ductwork, and all rectangular supply air ductwork, less than 1200mm (48") wide on discharge of fan systems with cooling coils.
 - .2 All ductwork on supply and discharge to HRV1 and HRV2.
 - .3 All ductwork for fresh air supply to HRV's and AHU's.
 - .2 50mm (2") Thickness
 - .1 All outside air ductwork.
- 2.8 REFRIGERANT PIPE INSULATION
- .1 Insulate all refrigerant piping lines with 12mm (1/2") Armstrong Armaflex AP sealed with Armstrong 520 adhesive. Refinish exposed and exterior insulation with Armstrong WB Armaflex finish.
 - .2 Cover outdoor insulation with aluminum jacket CSA HA Series-M1980.
 - .1 Crimped or embossed alloy jacketing 0.4mm thick with longitudinal slip joints and 50mm end laps with factory attached protective liner on interior surface. Aluminum alloy butt straps with mechanical fastener.
 - .2 Jackets on fittings, 0.4mm thick, die shaped components of alloy with factory attached protective liner on interior surface.
- PART 3 EXECUTION**
- 3.1 WORKMANSHIP
- .1 Work shall be performed by licensed journeymen.
 - .2 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations.
 - .3 Do not apply coverings until hydrostatic tests have been completed, surfaces are free of grease, scale, moisture, and heat tracing, where required, has been installed. Insulation shall be clean and dry when installed and during application of any finish.
 - .4 Apply insulation and coverings to equipment and piping which will operate with hot or warm liquid vapour, while surface is hot. Provide any required temporary heat to accomplish this.

- .5 Cold surfaces to be dry and ferrous surfaces to be coated with rust penetrating protective paint before applying insulation and vapour barriers.
- .6 Vapour barriers and insulation to be complete over full length of pipe or surface, without penetration for hangers, duct or seams, and without interruption at sleeves, pipe and fittings.
- .7 Install insulation with smooth and even surfaces, with round shapes laid to true circular and concentric shape, shaped to blend with fitting insulation and adjacent covering; with full length section and tight to insulated object.
- .8 Pack solid around all pipes where they pass through sleeves in walls, floor slabs, etc. for full thickness of floor with fibreglass or rockwool. Refer to firestopping clause where piping passes through fire separations. On all services, carry full insulation thickness through walls, floor, etc. protect insulation of exposed pipes passing through floors with 1.2mm (18 ga.) galv. Iron 150mm (6") from finished floor.
- .9 On piping, gouge out insulation for proper fit where there is interference between weld bead and insulation. Bevel insulation away from studs and nuts to permit their removal without damage to insulation. Closely and neatly trim around extending parts of pipe saddles, supports, hangers and clamp guides. Seal with insulating cement.
- .10 Use pipe covering protection saddles with roll type hangers unless otherwise indicated.
- .11 Butt joints
 - .1 Place joints on top of duct wherever practical. Butt joints on side of duct for flexible duct insulation.
 - .2 Adhere and seal laps of vapour barrier cover or vapour barrier strip of 100mm (4") minimum width furnished with insulation, using vapour seal adhesives.
- .12 Sagging of duct insulation will not be acceptable.
- .13 Stagger both longitudinal and horizontal joints, on duct insulation of multi-layered construction.
- .14 Duct insulation with vapour barrier shall be continuous, except at fire dampers.
- .15 Existing duct and pipe covering damaged or cut back during installation Work to be made good with same insulation as specified for new Work.
- .16 Protect insulation against elements during all stages of application.
- .17 Do not cover manufacturer's nameplates. Cut insulation on 45 deg. angle to nameplate edge and seal.
- .18 Covering to be uniform in diameter, smooth to finish. Place longitudinal seams so as to be invisible.

3.2 COLD INSULATION- PLUMBING

- .1 Fibreglass
 - .1 Insulate flanges, fittings and valve bodies, etc.
 - .2 Fasten longitudinal laps with staples and seal with Swifts Adhesive #3218.
 - .3 Butt joints wrapped with a 100mm (4") strip of ASJ. Stagger joints on multiple layers.
 - .4 Refinish exposed piping with canvas and coat with Bakor 120-18 white fire retardant lagging adhesive.

- .5 All firings shall be insulated by wrapping with 25mm (1") thick layers of 340g. (3/4 lb.) density flexible fibreglass attached with jute twine. Surface shall be wrapped with Friction Tape and sealed with an asphaltic sealing compound. Over this to be applied a smooth coating of insulating cement. Recover fittings with ASJ vapour seal jacket and brush coat with fire retardant white lagging adhesive.
- .2 Armaflex
 - .1 Insulate fitting, valve bodies, etc.
 - .2 All fittings shall be insulated with mitre-cut pieces of Armaflex AP pipe insulation the same size as on adjacent piping.
 - .3 Seal joints and seams with Armstrong 520 adhesive, and refinish exposed fitting with Armstrong Armaflex finish.
 - .4 Refinish all exposed piping with two coats of Armstrong Armaflex finish, colour selected by Contract Administrator.
 - .5 Where Armaflex insulation comes in close contact with adjacent equipment or piping having surface temperatures above 100 deg. C, Section 23 07 12 shall provide additional protection to ensure against deterioration of insulation by heat.
- 3.3 HOT INSULATION – PLUMBING
 - .1 Application as per Clause "Cold Insulation – Plumbing".
- 3.4 HOT INSULATION – HEATING
 - .1 Application as per Clause "Cold Insulation – Plumbing".
- 3.5 INSULATION CLADDING
 - .1 For aluminum jacketing installation, install in strict accordance with manufacturer's published recommendations.
- 3.6 White PVC Insulation Cover
 - .1 Preparation
 - .1 Proto Fitting Covers shall be applied on clean, dry surfaces.
 - .2 Application
 - .1 General
 - .1 The matching fibreglass insert shall either be wrapped completely around the fitting or snugly positioned inside the Proto Fitting cover for proper fit. The insert shall cover the full inner surface area of the Proto Fitting Cover. The Proto Fitting Cover shall then be applied over the fitting and insert, and the throat secured by either tack fastening, taping, sealing with a solvent type PVC adhesive, or bonding.
 - .2 Cold Pipe
 - .1 Fitting systems below ambient temperature must have a continuous vapour retarder, either with Proto PVC Tape, Proto Butt Strips, Proto PVC Adhesive, or a vapour retarder mastic as specified by the Contract Administrator. When using Proto PVC Tape, a 51mm (2") minimum downward overlap is recommended for optimum performance. Care should be taken not to stretch the last 51mm (2") of Proto PVC Tape, to avoid stretching or creeping.

- .3 Hot Pipe
 - .1 Insulate as per General Instructions given above. Due to PVC softening point at approximately 150 deg. F (70.6 deg.C.), care should be taken to ensure sufficient insulation thicknesses are applied. For hot piping which requires Knauf Pipe Insulation over 51mm (1- 1 ½") wall thickness, an extra fibreglass insert shall be applied for each additional inch of pipe insulation wall thickness. Knauf recommends the surface temperature of the pipe insulation and PVC to be no higher than 125 deg. F (52 deg. C). to complete application of Proto PVC Fittings on hot piping, the throat seam shall be riveted or tacked.
- .4 Outdoor Pipe
 - .1 Insulate as per above instructions. When installing Proto PVC fittings outdoors, add one layer aluminum foil over the first fibreglass insert applied, making sure the aluminum foil is extended over the adjacent pipe insulation. A second fibreglass insert shall then be applied over the aluminum foil, and the Proto PVC fitting applied.
 - .2 Minimum Proto PVC jacketing thickness for outdoor application should be .5mm (.020"). the PVC jacketing shall be overlapped a minimum of 51 mm (2") on the down side so as to shed water, longitudinal joints shall be completely weather sealed with solvent type PVC sealer. Circumferential joints shall be wrapped with a minimum 51mm (2") wide butt strips and completely sealed using a solvent type PVC sealer. On hot piping, insulation shall be of sufficient thickness to keep the surface temperature below 52 deg. C. (125 deg. F). additionally, a slip type expansion joint of 101mm (4") minimum width shall be applied at least every 6.1 lineal meters (20 lineal feet)
- 3.7 VAPOUR BARRIER FLEXIBLE DUCT INSULATION
 - .1 Rectangular Ductwork
 - .1 On ducts 600mm (24") wide and wider apply insulation to bottom surface of duct by impaling on welded pins on 300mm (12") centres. Spot adhesive on 300mm (12") centres on all sides of duct. Apply insulation with edges tightly butted together and secured with 100% coverage of 3-M No.17 or approved alternate. Staple joints and seal with 100mm (4") strips of vapour barrier foil of same quality as duct insulation membrane sealed with BF85-15.
 - .2 On ducts 575mm (23") wide or less insulation applied as above but welded pins may be omitted.
 - .2 Round Ducts
 - .1 adhere to duct surface applied in strips 150mm (6") wide, 300mm (12") o.c. Butt all edges of insulation, staple and seal all joints with tape adhered over the joint. Seal all breaks with vapour barrier type.
 - .3 Exposed Ducts
 - .1 Recover ducts exposed to view with 170 g. (6 oz.) canvas secured with Bakor 120-18 white fire retardant lagging adhesive. Finish with brush coat of same adhesive.
 - .4 Outdoor Ducts

- .1 On roof and other ductwork located outside of building, provide 26 ga. G.I. sheet metal cover to protect insulation. Seal all joints and make weather-tight.
- .2 On square or rectangular ductwork provide slight peak along top centre line so moisture will run off.

3.8 VAPOUR BARRIER RIGID DUCT INSULATION

- .1 Outdoor Ducts
 - .1 On roof and other ductwork located outside of building, provide 26 ga. G.I. sheet metal cover to protect insulation. Seal all joints and make weather-tight.
 - .2 Provide slight peak along top centre line so moisture will run off.

3.9 REFRIGERANT PIPE INSULATION

- .1 Insulate fittings, valve bodies, etc.
- .2 All fittings shall be insulated with mitre-cut pieces of Armaflex AP pipe insulation the same size as on adjacent piping.
- .3 Seal joints and seams with adhesive, and refinish exposed fittings with specified finish. Refinish all exposed piping with two additional coats.
- .4 Where insulation comes in close contact with adjacent equipment or piping having surface temperatures above 100 deg. C, provide additional protection to ensure against deterioration of insulation by heat.
- .5 Allow adhesive joints of Pipe Insulation to dry 24 hours to 36 hours before applying finish. Apply finish directly to clean, dry insulation in two coats. Wipe surface with cloth dampened with non-oily solvent such as alcohol or toluol to clean surface and remove powdered lubricant. Allow first coat to dry minimum of two hours before applying second coat. Before applying finish, read precautionary information on can label
- .6 Finish insulation located outdoor with Armstrong WB black Armaflex finish. Do not apply over joints freshly cemented with 520 adhesive. Allow adhesive joints of Armaflex pipe insulation to dry 24 to 36 hours before applying finish. Apply finish directly to clean, dry Armaflex insulation in two coats, wipe surface with cloth dampened with non-oily solvent such as alcohol or tuloul to clean surface and remove powdered lubricant. Allow first coat to dry minimum of two hours before applying second coat. Before applying Armaflex WB finish, read precautionary information on can label.
- .7 For aluminum jacketing insulation install in strict accordance with manufacturer's published recommendations. Make weather-tight application.

PART 1 GENERAL

1.1 GENERAL

- .1 All drawings and all specifications shall apply to and form an integral part of this section.
- .2 All latest additions of applicable codes are to be adhered to and are considered to be minimum standard requirements. It is noted in some cases the code requirements are exceeded where indicated on the drawings.

1.2 WORK INCLUDED

- .1 Work to include Labour, materials, plant, tools, equipment and services necessary and reasonably incidental for complete installation, testing and placing in initial operation of the HVAC system described and shown on drawings and specifications.

1.3 RELATED SECTIONS

- .1 Common Work Results – Mechanical Section 23 05 00
- .2 Insulation Section 23 07 12
- .3 Controls Section 25 30 00
- .4 Testing, Adjusting and Balancing Section 23 05 93
- .5 Common Work Results – Mechanical Section 26 05 00

1.4 REFERENCES

- .1 ANSI/NFPA (Latest Edition)- Installation of Air Conditioning and Ventilating Systems
- .2 ANSI/NFPA (Latest Edition)- Installation of Warm Air Heating and Air Conditioning Systems
- .3 NFPA 54 (AGA Z223.1) – National Gas Code
- .4 Ashrae 90A – Energy Conservation in New Building Design
- .5 Ashrae 62 (latest edition) – Ventilation for Acceptable Indoor Air Quality
- .6 SMACNA 006- 2006- HVAC Duct Construction Standards Metal and Flexible

1.5 SUBMITTALS FOR REVIEW

- .1 A minimum of six (6) copies of manufacturers shop drawings for all the new equipment shall be submitted for approval prior to placing order.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Refer to equipment schedules on drawings for specific product information including but not limited to air handling units, heat recovery ventilators, exhaust fans, grilles, dampers, etc.
- .2 Equipment and materials are to be new and CSA approved.
- .3 Ductwork, fittings, hangers to Ashrae and SMACNA standards (latest editions)

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Equipment shall be installed in strict accordance with manufacturers recommendations and standards.
- .2 The latest edition of all codes and standards shall apply. Obtain all permits, approvals and the like required to complete the Work ready for operation.
- .3 Finish all materials, labour, tools and equipment necessary to complete the Work as shown on Drawings and herein specified.
- .4 All workmanship and fabrication shall meet with the standards set for this trade. All work shall be done by competent and experienced workmen.
- .5 Products used by Contractor other than those specified on plan or in specifications, including alternate and/or approved equal in accordance with B6 items that may incur additional cost to this project for dimension difference, modification to structure, power, control requirements or other reasons, the Contractor will bear all additional costs to make all systems functional.
- .6 Support all equipment and ductwork securely to the building structure.
- .7 All equipment shall be supported with galvanized hanger rod, canstrut or painted angle iron members, clamps and saddles. Wire hangers or perforated straps will not be accepted.
- .8 Duct installations shall conform to SMACNA 006-2006 HVAC Duct Construction Standard – Metal and Flexible.
- .9 Construct ducts in accordance with the dimensions shown on the plans, where possible. Where necessitated by building construction, alter these dimensions maintaining the same equivalent duct size. Size ducts from ASHRAE Table of Equivalent Rectangular and Round Ducts or approved acceptable engineering methods. Any changes shall be approved by the Contract Administrator and noted on the as- built drawings.
- .10 All duct and plenum dimensions as indicated on the drawings refer to clear inside duct dimensions.
- .11 Provide U.L. listed fire damper or fire stop flap for wall, floor, attic and ceiling as indicated on plans. These are life safety items and shall be carefully done. If they are not indicated, the Contractor to provide fire damper at fire separation as requested by the Authority having jurisdiction without additional cost to the City. Installation shall conform to manufacturer's instructions with retaining angles and breakaway joints, Contractor shall provide airtight duct access at convenient location, to access fusible links to facilitate testing and maintenance, at all fire damper locations.
- .12 Brace all ducts properly, so as not to interfere with the free flow of air, make air tight and free from buckling and sagging. All flat surfaces to be cross broken.
- .13 All bends, tees and elbows shall be made with a centre line radius of not less than 1-1 ½ times the width of the duct in the plane of rotation of the radius and where this is not possible, such turns will be fitted with double turning vanes (at 64mm on centre) of the proper sizes, airfoil type turning vanes, Hart & Cooley ducturns.
- .14 Low Pressure Rectangular Ductwork Schedule

<u>Max Side</u>	<u>Bracing</u>
.1 Up to 600mm (24")	None

- .1 Gauge: .60mm (24 USSG)
 - .2 635mm to 750mm (25" to 30") 25mm (1") x 25mm (1") x 3.2mm (1/8") angle, 1.2m (4'0") from joint.
 - .1 Gauge: .60mm (24 USSG)
 - .3 785mm to 1000mm (31" to 40") 25mm (1") x 25mm (1") x 3.2mm (1/8") angle, 1.2m (4'0") from joint.
 - .1 Gauge: .80mm (22 USSG)
 - .4 1040mm to 1.5m (41" to 60") 37.5mm (1-1 1/2") x 37.5mm (1- 1 1/2") x 3.2mm (1/8") angle, 1.2m (4'0") from joint.
 - .1 Gauge: .80mm (22 USSG)
- .15 Round Ductwork Schedule
- | | <u>Duct Diameter</u> | <u>Gauge</u> |
|----|-----------------------------|-----------------|
| .1 | Up to 508mm (20") | 0.5mm (26 ASSG) |
| .2 | 533mm to 1.02m (21" to 40") | 0.6mm (24 ASSG) |

- .16 Provide "Shaftloc" damper locking quadrant with damper position indicator (close-open) for all manual balancing dampers.
- .17 All laps shall be in the direction of air flow. Rivets and bolts shall be used throughout. All edges and slips to be hammered down to leave a smooth interior duct.
- .18 Connect ductwork to furnace with 75mm Duro-Dyne flexible connection or as specified elsewhere, secure in place with rigid strapping and make airtight.
- .19 Seal all transverse joints and connections air tight with gaskets, sealant or combination thereof. Longitudinal seams unsealed. Use an approved duct dealer on all joints and seams. No duct tape allowed.
- .20 All horizontal ductwork shall be supported by non-perforated, galvanized steel hanger strap or rod. Hanger strap to be next sheet metal thickness heavier than duct at a maximum of 2400mm on centre. Maximum size duct supported by strap hanger, 500mm. Hanger rod size 6mm c/w 40 x 40 steel support angle. Wire hangers or perforated straps will not be accepted. Hangers and supports shall not damage or pierce insulation.
- .21 Contractor to provide additional bracing and/ or support for any ductwork or equipment, on request by the Contract Administrator, if not adequately braces, at no additional cost to the City.
- .22 Duct hangers, supports, bolts, rods and sleeves, etc. shall be of galvanized (non-rust) or stainless steel type.
- .23 No cutting of beams, columns or slabs will be allowed without the approval of the Contract Administrator for the installation of ductwork, etc. Protect all Work from damage, any Work defaced must be repaired by the Contractor.
- .24 Seal all duct openings made in the building structure properly to provide a weather tight, water proof seal.
- .25 At completion of project, clean interior of all ductwork.
- .26 Air balancing of the air conditioning/heating system done by Section 25 05 93. Section 23 54 11 shall provide initial set up/adjustment of all HVAC equipment. Section 23 54 11 shall coordinate with the Air Balance Agency to assure the installation of all manual adjusting dampers are as required to allow proper adjustment of the air system.
- .27 Section 23 54 11 shall make any adjustments to equipment controls/settings and any additional manual dampers for correct balance as recommended by the Air Balance Agency, at to additional cost to the City.
- .28 The plans are considered as diagrammatic only and the Contract Administrator reserves the right to change the location of equipment or piping within 300mm of where shown provided such change is made before installation.
- .29 System schematics shown on plans are of minimum requirements. Equipment installation including all controls, fittings, and accessories shall be in strict accordance with manufacturer's instructions, and Contractor shall include and bear all cost for such installations.
- .30 At the completion of the job, provide one set of as-built drawings showing wiring diagram, system equipments, operation descriptions and maintenance procedures, etc. in transparent plastic laminate sheet. Identify all dampers clearly and accurately on the as-built drawings. Attach these drawings onto a convenient wall location for instructing service personnel and the City.

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 All drawings and all sections of these specifications apply to and form an integral part of this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- .1 Common Work Results – Electrical Section 26 05 00
- .2 HVAC System Section 23 54 11
- .3 Testing, Adjusting and Balancing Section 23 05 93
- .4 Mechanical Equipment Connections Section 26 05 47
- .5 Electrical

1.3 WORK INCLUDED

- .1 Provide a complete system of INVENSYS Building Systems electric controls as installed by BARCOL Controls Ltd.
- .2 System control shall include:
 - .1 AHU Control (typical for 2 AHU's);
 - .2 HRV Control (typical for 2 HRV's)

1.4 REFERENCE STANDARDS

- .1 Conform with the requirements of the plans and specifications, the local Authorities having Jurisdiction and the National Building Code. In the case of conflicting requirements, be governed by the more severe regulations.
- .2 Use latest edition of all referenced codes, standards, regulations, etc.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Electrical equipment must bear CSA label and shall bear ULC label attesting to having met test standards of agencies and being listed on their approved lists.
- .2 Tanks shall bear approval of Manitoba Department of Labour and where applicable shall bear approval of Underwriter's Laboratories of Canada.

1.6 SAMPLES

- .1 Submit all samples requested by the Contract Administrator.

1.7 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with General Conditions of all items requiring coordination into the Work.
- .2 Clearly indicate:
 - .1 Scales and operating ranges for temperature and pressure indicators.
 - .2 Leakage and flow characteristic data for all control dampers.

- .3 Shop drawings are required for
 - .1 Control panels.
 - .2 Control diagrams.
 - .3 Equipment.
 - .4 Dampers.
 - .5 Thermostats.
- 1.8 CO-ORDINATION
 - .1 Section 23 54 11 shall mount all motorized dampers supplied by this Section in their respective locations in the ductwork. Section 23 54 11 shall also be responsible for distribution of dampers to the various locations on the job site.
 - .2 All electrical control wiring, including interlock wiring required for the mechanical equipment shall be supplied and installed by the electrical Division 26.
 - .3 All temperature control wiring 50 volts or more shall be a minimum of #14 gauge wire. All temperature control wiring less than 50 volts shall be minimum #18 gauge wire. All wiring shall be run in conduit including low voltage control wiring.
 - .4 Division 26 - Electrical shall provide the following:
 - .1 All power wiring to equipment.
 - .2 One 15 amp 120/1/60 circuit and power wiring to each Mechanical Room and control panel.
- 1.9 MAINTENANCE DATA
 - .1 Provide maintenance data in English for incorporation into maintenance manuals, including diagrams, specification sheets and maintenance and repair instructions.
 - .2 Supply control diagrams mounted permanently on hard board and plasticized. Install adjacent to the equipment in each Mechanical Room.
- 1.10 STANDARD OF ACCEPTANCE
 - .1 Standard of Acceptance: INVENSYS Building Systems or approved equal in accordance with B6.
 - .2 INVENSYS model numbers have been used as standard, unless otherwise noted.
- 1.11 OPERATING INSTRUCTIONS
 - .1 Provide operating instructions for the temperature control system in accordance with the General Conditions of the Contract and include a description of the sequence of operation and "as-built" drawings of the system schematics.
- 1.12 SERVICE AND GUARANTEE
 - .1 Upon completion of the installation, all control equipment supplied under this Contract shall be adjusted to place the system in complete operating condition subject to the Contract Administrator's approval. All adjustments shall be made in co-ordination with the Contract Administrator. The control systems shall be guaranteed against defects in workmanship and material for a period of one (1) year under normal use and service from the date of beneficial occupancy.

PART 2 MATERIALS

2.1 PANELS

- .1 Provide all prewired control panels, except those furnished as part of equipment under other sections.
- .2 Fabricate fully enclosed cabinets using all steel construction.
 - .1 Use bold or cover plate or hinged door with locking latch. Common key to all locks.
 - .2 Finish with two (2) coats of paint.
 - .3 Furnish wall mounted or free standing panel as indicated on the drawings.
 - .4 Mount all routinely operated, manually adjusted indicating devices on cover of door. Enclose all other devices.

2.2 CONTROL DAMPERS

- .1 Provide all control dampers of the sizes and type indicated on the plans.
- .2 Leakage shall not exceed 1% with an approach velocity of 7.6 m/s when the damper is closed against 1000 Pa.

2.3 DAMPER OPERATORS

- .1 Damper operators as indicated on plans.
- .2 Operators shall be direct mount type.
- .3 Valve operators shall be of type to withstand temperatures likely to be encountered in application.

2.4 AHU THERMOSTATS

- .1 As indicated on plans.

2.5 HRV CONTROLLERS

- .1 As indicated on plans.

2.6 MISCELLANEOUS DEVICES

- .1 Provide all necessary relays, positioners, clocks, transformers, etc. to make a complete and operable system.

PART 3 SEQUENCE OF OPERATION

3.1 AHU CONTROL (TYPICAL OF 5 UNITS)

- .1 The thermostat shall control the AHU on an occupied/unoccupied schedule. During the occupied mode the AHU will operate to maintain the space temperature set point. During the unoccupied mode, the AHU will be cycled by a space thermostat to maintain the space temperature at the night set back set point. The control Contractor to install and wire all controls provided by the AHU supplier, or shown on plans.

3.2 HRV CONTROL (TYPICAL OF 2 UNITS)

- .1 The HRV's shall be controlled by the controller shown on the plans. The HRV's shall be interlocked with the respective AHU's such that the interlock will provide speed control as required (ie. HRV1 and HRV2 to run continuously at low speed, when either AHU1 or AHU2 are running. The respective HRV will run at medium speed, when both AHU1 and AHU2 are running both HRV1 and HRV2 will run at high speed).

PART 1 GENERAL

1.1 RELATED WORK

- .1 General Requirements Section 01 00 00
- .2 All Electrical Drawings

1.2 QUALITY ASSURANCE

- .1 Do complete installations in accordance with CSA C22.1-2002.
- .2 While not identified and specified by number in this Division, comply with CSA Electrical Bulletins in force at time of tender submission. Comply with the requirements of all Provincial and local laws, rules, ordinances and codes.
- .3 Electrical installation shall be in accordance with the current edition of the Canadian Electrical Code, Provincial and other codes, rules and regulations. Supply material and labour required to meet the requirements of these codes, rules and regulations even though the Work is not shown on the drawings or mentioned in the specifications. Where the electrical installation calls for better quality materials or construction than the minimum requirements of these codes, rules and regulations, the electrical installation shall be as shown on the drawings and as specified.
- .4 Electrical installation shall be in accordance with the requirements of the electrical supply authority and local inspection authority.

1.3 PERMITS, FEES

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of the Work.
- .2 Obtain all necessary permits and pay all fees as required for the electrical installation.

1.4 MATERIALS AND EQUIPMENT

- .1 Provide labour, materials, transportation, equipment and facilities, etc., required for the complete electrical installation as indicated or implied on the drawings and specifications.
- .2 Electrical equipment shall be new and of type and quality specified.
- .3 Equipment and material shall be CSA certified, and manufactured to standards described. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the appropriate inspection Departments.

1.5 SUBMITTALS

- .1 Submit shop drawings and product data for review by the Contract Administrator. All drawings shall be in English and Imperial dimensions or in metric where indicated. Manufacture of equipment shall not commence until shop drawings have been reviewed.
- .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material. Where applicable, include wiring, single line and schematic diagrams.
- .3 Submit shop drawings of service entrance equipment to utilities.
- .4 Material submitted for Contract Administrator's review shall bear Contractor's, and where applicable, Utility reviewed stamp.

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- 1.6 OPERATIONS AND MAINTENANCE DATA
- .1 Provide operation and maintenance data for incorporation into Maintenance Manuals, including names and addresses of local suppliers for items included in Maintenance Manuals.
 - .2 Include details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .3 Include technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
 - .4 Include wiring and schematic diagrams and performance curves.
 - .5 Submit 4 copies of Maintenance Manuals to the Contract Administrator for review. Manuals that are incomplete shall be returned to the Contractor for completion. Completed manuals shall be submitted, to the satisfaction of the Contract Administrator, before substantial completion may be considered.
- 1.7 VOLTAGE RATINGS
- .1 Operating voltages: to CAN3-C235-83.
 - .2 Motors, electrical heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment shall operate in extreme operating conditions established in above standard without damage to equipment.
- 1.8 INSPECTION
- .1 Furnish a Certificate of Acceptance from the Inspection Authorities on completion of the Work. Copies of certificate shall be included in Maintenance Manuals. Certificate shall be submitted before final payment may be considered to be due.
 - .2 During the course of the project construction, the Contract Administrator will carry out periodic site reviews and prepare a deficiency list for remedial action by the Contractor. The Contractor shall respond in writing to the Contract Administrator, stating corrective action and completion date for each item listed as deficient.
- 1.9 CARE, OPERATION AND START-UP
- .1 Instruct the City's operating personnel in the operation, care and maintenance of equipment. Arrangement of such instructional sessions shall be done at a time convenient to the City, and ensure that operating personnel are conversant with all aspects of its care and operation.
 - .2 Arrange and pay for services of Manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.
- 1.10 FINISHES
- .1 Finish outdoor electrical equipment – standard colour.
 - .2 Clean and touch up surfaces of shop-painted equipment, scratched or marred during shipment or installation, to match original paint.
 - .3 Clean, prime and paint exposed hangers, racks, fastenings to prevent rusting.
- 1.11 EQUIPMENT IDENTIFICATION
- .1 Identify electrical equipment with lamacoid nameplates.

- .2 Provide lamacoid nameplates, 3mm ($\frac{1}{8}$ ") thick plastic engraving sheet, black or red face, white core, mechanically attached (screwed or riveted) unless specified otherwise. Sizes as follows:

Size 0	10 x 38mm	($\frac{3}{8}$ " x 1- $\frac{1}{2}$ ")	1 line	3mm	($\frac{1}{8}$ ") high letters
Size 1	10 x 100mm	($\frac{3}{8}$ " x 4")	1 line	3mm	($\frac{1}{8}$ ") high letters
Size 2	13 x 75mm	($\frac{1}{2}$ " x 3")	1 line	5mm	($\frac{3}{16}$ ") high letters
Size 3	13 x 75mm	($\frac{1}{2}$ " x 3")	2 lines	3mm	($\frac{1}{8}$ ") high letters
Size 4	19 x 75mm	($\frac{3}{4}$ " x 3")	1 line	10mm	($\frac{3}{8}$ ") high letters
Size 5	19 x 100mm	($\frac{3}{4}$ " x 4")	2 lines	5mm	($\frac{3}{16}$ ") high letters
Size 6	25 x 100mm	(1" x 4")	1 line	13mm	($\frac{1}{2}$ ") high letters
Size 7	25 x 100mm	(1" x 4")	2 lines	6mm	($\frac{1}{4}$ ") high letters

- .3 Wording on nameplates shall be approved prior to manufacture. Submit schedule of nameplates and wording.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification shall be English.
- .6 Nameplates for terminal cabinets and junction boxes shall indicate system and/or voltage characteristics.
- .7 Use black nameplates with white lettering for normal power and communications equipment. Use red nameplates with white lettering for emergency power and fire alarm equipment.

1.12 PROJECT RECORD DOCUMENTS

- .1 The Contractor shall be responsible for the production of electrical as-constructed drawings which shall provide a complete and accurate record of the actual electrical installation. The Contractor shall affix his company name and the words "Record Drawings" on the drawings, and sign and date them. Submit hard copy for final review and submission to the City upon completion. Record documents that are incomplete shall be returned to the Contractor for remedial measures.

1.13 LABELS AND WARNING SIGNS

- .1 Manufacturer's nameplates and CSA labels shall be visible and legible after equipment is installed.
- .2 Provide warning signs on equipment, as required, to meet the requirements of the Inspection Authorities, including indication of multiple power sources.

1.14 EQUIPMENT MATERIALS AND EQUIPMENT

- .1 Contractors shall submit a bid opportunity based on the specified materials and equipment only.
- .2 Contractors may submit a bid opportunity based on equivalent materials and equipment only if such items have been approved as equals by the Contract Administrator.
- .3 Contractors may submit, with their bid opportunity, an alternate price based on alternate materials and equipment only if such items have been approved as alternates by the Contract Administrator.
- .4 Submissions for equals in accordance with B6 shall be received by the Contract Administrator. Submittal list will be returned by facsimile machine, where a number is shown, or may be picked up at the Contract Administrator's Office.

- 1.15 LOCATION OF OUTLETS
- .1 Locate outlets as indicated.
 - .2 Do not install outlets back-to-back in wall; allow minimum 400mm (16") horizontal clearance between boxes.
 - .3 Drawings are schematic only and do not indicate all architectural or structural elements.
 - .4 Change location of outlets at no extra cost or credit, providing distance does not exceed 3m (10' - 0") and information is provided before installation.
 - .5 Locate light switches on latch side of doors, or as indicated on drawings.
 - .6 Vertically and/or horizontally align outlets of different systems when shown in close proximity to each other and occurring at different mounting heights, or as indicated on drawings.
 - .7 Coordinate mounting heights and location of all equipment with Architectural, Mechanical and Structural Drawings prior to installation of rough-in boxes.
- 1.16 MOUNTING
- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicate otherwise.
 - .2 If mounting height of equipment is not indicated, verify with Contract Administrator before proceeding with installation.
 - .3 Install electrical equipment at the following heights unless indicated or directed otherwise (to middle of outlet).
 - .1 Outlets above counters: 150mm (6"): splashbacks: 100mm (4").
 - .2 General receptacles, telephone and television outlets: 400mm (16").
 - .3 Receptacles in mechanical areas: 1m (40").
 - .4 Switches, dimmers, push buttons: 916mm (36").
 - .5 Fire alarm pullstations, thermostats: 1200mm (46").
 - .6 End of line resistors: 1.6m (64").
 - .7 Fire alarm bells, horns, speakers: 2.2m (88").
 - .8 As per Architectural elevations.
 - .9 Heights as above or at bottom of nearest block or brick course.
 - .10 Occupancy sensor as per Manufacturer's instruction.
- 1.17 PROTECTION
- .1 Protect exposed live equipment during construction for personnel safety.
 - .2 Shield and mark live parts "LIVE () VOLTS", with appropriate voltage in English.
 - .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision.
- 1.18 LOAD BALANCE

- .1 **Measure phase current to panelboards with normal loads operating at time of measurement. Adjust branch circuit connections as required to obtain best balance of current between phases, record changes and add to record drawings.**
- 1.19 CONDUIT SLEEVES AND HOLES
 - .1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete shall be sized for free passage of conduit.
 - .2 Holes through exterior walls and roof shall be flashed and made weatherproof.
 - .3 Make necessary arrangements for cutting of chases, drilling of holes and other structural Work required to install electrical conduits, cables, pullboxes and outlet boxes.
 - .4 Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- 1.20 FIREPROOFING
 - .1 Where cables or conduits pass through floors, block or concrete walls and fire rated walls, seal openings with fire-stopping material with intumescent properties.
 - .2 Fire proofing of electrical cables, conduits, trays, etc., passing through fire barriers shall conform to local codes and inspection authorities.
 - .3 Fire stop materials shall be asbestos free and have been tested in accordance with ASTM E-84, E-136 and E-814 and UC-1479.
 - .4 Approved Manufacturer:
 - .1 Nelson Firestop Products.
 - .2 Spec Seal.
- 1.21 INSULATION RESISTANCE TESTING
 - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.
 - .3 Check resistance to ground before energizing.
- 1.22 CLEANING
 - .1 Do final cleaning in accordance with Section 01 74 00 – Cleaning and Waste Processing.
 - .2 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.
- 1.23 DELIVERY STORAGE AND HANDLINGS
 - .1 Deliver all materials to site in an orderly fashion.
 - .2 Store all materials in a clean and dry place, secure from vandalism or theft. All materials shall be left in shipping containers until required for use.
 - .3 Provide addition protection such as tarps, padding, wood skids, etc., where such is required to ensure protection of equipment.
- 1.24 COORDINATION WITH OTHER TRADES
 - .1 **Refer to Mechanical, Structural, Architectural and Interior Design drawings and specifications for additional electrical Work in connection with other Divisions. Where such Work is included in other sections of the specifications, provide**

equipment, conduit, wiring, etc. (in accordance with the Manufacturer's approved shop drawings), as required, for operation of the specified equipment.

- .2 **Coordinate electrical Work with Work of other trades to avoid conflicts with pipes, air ducts or other equipment. Provide additional supports, wiring, etc. to relocate electrical equipment, as required, where structural members, air ducts, piping or other equipment interferes with the electrical installation.**

1.25 EXAMINATION OF SITE AND CONSTRUCTION DOCUMENTS

- .1 **Prior to submitting a bid, examine the site and local conditions which will affect the Work. Refer to the Architectural, Mechanical and Structural drawings, schedules and specifications for construction details to be certain that the electrical Work can be satisfactorily carried out as specified. Claims for extra payments, resulting from conditions which could reasonably be foreseen during an examination of the documents and/or site, will not be recognized.**
- .2 Ensure that all equipment designate as "Existing to Remain" or "Existing to be Relocated" is suitable for its intended re-use, including panelboards and circuits. Report any discrepancies to the Contract Administrator in accordance with B4.
- .3 Refer to Bidding Procedures for instructions regarding any pre-arranged site visit during the bidding period.

1.26 CUTTING AND PATCHING

- .1 Pay the costs of all cutting and patching required for the installation of electrical Work. Payment for cutting and patching shall be made through the Contractor.
- .2 Obtain the approval of the Contract Administrator before arranging for any cutting. Patching shall restore the affected area to the original condition; materials and methods used for patching shall be in accordance with the requirements of the corresponding Divisions of the specifications.

1.27 WORKMANSHIP

- .1 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance to the satisfaction of the Contract Administrator. Install conduit and cable runs parallel and perpendicular to building lines in chases, behind furring or above ceilings, where such concealment is possible. In areas where systems shall be exposed, install neatly and group in a tidy appearance.
- .2 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement, with adequate clearances and accessibility for same.
- .3 Replace Work unsatisfactorily to the Contract Administrator without extra cost.

1.28 ACCESS DOORS

- .1 Access doors shall be a minimum #12 gauge prime coat painted bonderized steel. Each shall be complete with a heavy flush frame and anchor, concealed hinges, positive locking screwdriver lock, and mounting and finishing provisions to suit the finish material for which they are supplied. Access doors in fire rated ceilings, walls, partitions, structures, etc. shall be U.L.C. listed and labelled and of a rating to maintain the fire separation integrity.
- .2 Before commencing installation of electrical Work submit, to the Contract Administrator for approval, a list of required access doors showing the exact sizes and locations of such access doors. Locate access doors in walls and partitions to the Contract Administrator's approval, and arrange electrical Work to suit. Access doors shall be,

wherever possible, of a standard size for all applications. Confirm exact dimensions with the Contract Administrator, prior to ordering.

- .3 Access doors shall be installed by the Division responsible for the particular type of construction in which access doors are required. Supply the access doors to the Division installing same at the proper time to avoid construction delays.
- .4 Completed and approved Maintenance Manuals as per Section 26 05 00. 1.6.
- .5 Completed and approved Record Drawings as per item 26 05 00. 1.12

PART 2 PRODUCTS

- 2.1 Not Used
- .1 Not used.

PART 3 EXECUTION

- 3.1 Not Used
- .1 Not used.

PART 1 GENERAL

1.1 REFERENCES

- .1 CSA C22.2 No.65-1956 (R1965) Wire Connectors.
- .2 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install pressure type wire connectors and tighten.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.
 - .3 Install fixture type connectors and tighten. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Common Work Results – Electrical Section 26 05 00
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 26 05 34
- .3 Fastenings and Support Section 26 05 29

1.2 REFERENCES

- .1 CSA C22.1-02 – Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 0.3 – Test Methods for Electrical Wires and Cables.
- .3 CSA C22.2 No. 48-M90 (R2000) – Non-metallic Sheathed Cable.
- .4 CSA C22.2 No. 51 Armoured Cables.
- .5 CSA C22.2 No. 52-96 (R2000) – Underground Service-Entrance Cables.
- .6 CAN/CSA C22.2 No. 65-03 (CSA/UL/ANCE) – Wire Connectors.
- .7 CSA C22.2 No. 75-03 (CSA/UL/ANCE) – Thermoplastic-Insulated Wires and Cables.
- .8 CSA C22.2 No. 123 Aluminum Sheathed Cables.
- .9 CSA C22.2 No. 131 Type TECK 90 Cable.
- .10 NECA (National Electrical Contractors Association) – Standard of Installation.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Conductors in Conduit:
 - .1 Type: RW90
 - .2 Conductors:
 - .1 Solid Copper #10 AWG and smaller.
 - .2 Stranded Copper #8 AWG and larger.
 - .3 Sized as indicated (Minimum #12 AWG).
 - .3 Insulation: Cross link polyethylene (RW90), (RWU90), 90 deg. C.
 - .4 Configuration: Single conductor.
 - .5 Voltage Rating: Minimum 600V.
 - .6 Certification: CSA C22.22 No. 38 or latest revision.
- .2 Armored Cable (BX):
 - .1 Type: AC90.
 - .2 Conductors:
 - .1 Solid Copper #10 AWG and smaller.
 - .2 Stranded Copper #8 AWG and larger.

- .3 Sized as indicated (Minimum #12 AWG).
- .3 Insulation: Cross link polyethylene (RW90), (RWU90), 90 deg. C.
- .4 Configuration: Multi-conductor, as required, c/w a separate bare CU ground wire.
- .5 Voltage Rating: Minimum 600V.
- .6 Certification: CSA C22.22 No. 51 or latest revision.
- .3 Armored Cable (TECK)
 - .1 Type: TECK
 - .2 Conductors:
 - .1 Solid Copper #10 AWG and smaller.
 - .2 Stranded Copper #8 AWG and larger.
 - .3 Sized as indicated (Minimum #12 AWG).
 - .3 Insulation: Cross link polyethylene (RW90), 90 deg. C.
 - .4 Configuration: Multi-conductor, as required, c/w a separate bare CU ground wire.
 - .5 Voltage Rating: 1KV, 5 KV, or 15KV as indicated.
 - .6 Inner Jacket:
 - .1 Black polyvinyl chloride (PVC).
 - .2 Low Flame Spread (LFS).
 - .3 Low Gas Emission (LGE).
 - .7 Armor: Inter-locked aluminum
 - .8 Outer Jacket:
 - .1 Black polyvinyl chloride (PVC), -40 deg. C.
 - .2 Low Flame Spread (LFS).
 - .3 Low Gas Emission (LGE).
 - .9 Flame Rating: FT4
 - .10 Certification: CSA C22.22 No. 131 or latest revision.
- .4 Low Voltage Control Cables
 - .1 Type: LVT.
 - .2 Conductor: Solid Copper #18 AWG.
 - .3 Insulation: Thermoplastic, colour coded.
 - .4 Configuration: single, two conductor – parallel, three or more conductors twisted.
 - .5 Voltage Rating: 30V.
 - .6 Outer Jacket: thermoplastic.
 - .7 Certification: CSA C22.22 No. 35
 - .8 Flame Rating: FT4.

- .5 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs as required.
- .6 RA90 Cables
 - .1 Single conductor RW90 insulation, minimum 600V, -40C.
 - .2 Stranded copper, size as indicated.
 - .3 Liquid and vapour tight corrugated aluminum sheath.
 - .4 Overall PVC jacket rated FT-4.
- .7 Variable Frequency Drive Power Cables
 - .1 For input power wiring to the VFD and for output wiring to the motor, from the VFD.
 - .2 Use cable specifically designed for Variable Frequency Drives.
 - .1 Teck Drive RX cable as manufactured by Alcatel.
 - .2 PVC jacket rated at FT4.
 - .3 Continuous corrugated impervious aluminum shield.
 - .4 CSA approved to standard C22.2 No. 123-96.
 - .5 Teck Drive RX cables are to be installed in connectors specifically made for use with the Drive RX cables.
 - .6 Terminate the Drive RX cable grounds as per the cable manufacturer's instructions, using ground bushings as directed. The ground connections are to be made at the ground points indicated by the VFD manufacturer. Coordinate with Division 15.
 - .7 Installed as per manufacturer's instructions.

PART 3 EXECUTION

3.1 GENERAL

- .1 All branch circuit wiring and conduit shall be installed to minimize voltage drop. Install additional conduit runs as required to take the most direct and shortest route to outlets, light fixtures, etc.

3.2 INSTALLATION IN RACEWAYS

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 00 – Common Work Results – Electrical.
 - .2 In underground ducts in accordance with Section 26 05 44 – Installation of Cables in Trenches and in Ducts.
 - .3 Ensure conduits are dry and free of debris before pulling cables.
 - .4 Colour coding and identification as per the C.E.C.
 - .5 Wires in outlet, junction and switch boxes, not having a connection within box shall not be spliced, but shall continue unbroken through the box.
 - .6 Branch circuits exceeding 21 metres shall be #10 AWG, branch circuits exceeding 35 metres shall be #8 AWG.

3.3 INSTALLATION OF SINGLE CONDUCTOR CABLES

- .1 Single conductor cables shall be installed one cable diameter apart on suspended cable tray or channel supports and shall be clamped with aluminum cable clamps. Cables shall be terminated using non-magnetic connectors. Cable armor shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG bare (unless otherwise noted) copper ground wire shall be installed with each feeder. Cable bending radius shall be at least twelve times the overall cable diameter and bends shall not damage or distort the outer sheath.
- .2 Do not install PVC jacketed cables in circulating air plenums.
- .3 Single conductor cables installed underground shall be installed in the installation configuration outlined in Appendix B of the Canadian Electrical Code to provide the allowable ampacity required for the feeder.

3.4 INSTALLATION OF FLEXIBLE ARMoured CABLE

- .1 Type AC90 armoured cable (BX) shall be used for connections from conduit systems to recessed luminaries in accessible ceilings. Cable to be of sufficient length to allow the lighting fixture to be relocated to any location within a 1.8M (6') radius. Cable shall be clamped before entering the lighting fixture and shall be clipped before entering the conduit system junction box.

3.5 INSTALLATION IN EQUIPMENT

- .1 Group and lace-in neatly wire and cable installed in switchboards, panelboards, cabinets, wireways and other such enclosures.

3.6 TERMINATIONS

- .1 Terminate wires and cables with appropriate connectors in an approved manner.

3.7 IDENTIFICATION

- .1 Wire in conduit #2 AWG and smaller shall have solid coloured insulation, colour coded as per Canadian Electrical Code.
- .2 Wire in conduit 1/0 AWG and larger and single conductor cables for normal power feeders shall be identified at each outlet box and termination with a 150 mm band of coloured vinyl tape of the appropriate colour. Emergency power feeders shall be provided with an additional 75 mm band of red vinyl tape installed adjacent to the 150 mm band of the coloured phase identification tape, as listed below. Neutral and ground conductors shall be identified. Paint or other means of colouring the insulation shall not be used.
- .3 Identify control conductors in motor control equipment, contactors, fire alarm panels, etc. with mylar/cloth wire markers.
- .4 Refer to Section 26 05 00 – Common Work Results – Electrical for additional requirements.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Common Work Results – Electrical Section 26 05 00
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 26 05 34
- .3 Wires and Cables Section 26 05 21

1.2 REFERENCES

- .1 CSA C22.1 – Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.
- .2 CECA – Canadian Electrical Contractors Association.

PART 2 PRODUCT

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41mm, 2.5mm thick, surface mounted, suspended or set in poured concrete walls and ceilings or as required.
 - .1 Manufacturers: B-Line, Burndy, Electrovert, Unistrut, Pilgrim, Pursley.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with cast in or 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. Provide additional support as required.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole malleable iron straps to secure surface conduits and cables 50mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50mm.
 - .3 Beam clamps to secure conduit to exposed steel Work.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6mm diameter threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1500mm oc 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 Contract Administrator.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Threaded rod to be minimum 6mm diameter galvanized or nickel plated. Black steel rod is not acceptable.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Common Work Results – Electrical Section 26 05 00
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 26 05 34
- .3 Fastenings and Supports Section 26 05 29

1.2 LOCATION

- .1 Locate splitters, junction and pull boxes as indicated or as needed for each system.

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 to match required size and number of incoming and outgoing conductors as indicated.
- .3 Minimum three spare terminals on each set of lugs in splitters.
- .4 Explosion proof in hazardous areas to suit the hazardous classification.
- .5 Weatherproof where installed outdoors.
- .6 Enclosures in other areas to suit environment.

2.2 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25mm minimum extension all around, for flush-mounted pull and junction boxes.
- .3 Cast type with gasketed covers where exposed to weather.
- .4 Explosion proof in hazardous areas to suit the hazardous classification.

2.3 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19mm G1S fir plywood backboard. Cabinets to be flush or surface mounted as indicated.
- .3 Provide other systems cabinets as specified and located on drawings.

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.

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- .2 Mount cabinets with top not higher than 2m above finished floor, or as indicated on drawings.
 - .3 Install terminal block as indicated.
 - .4 Install pull boxes so as not to exceed 30m of conduit run between pull boxes.
 - .5 Install junction and pull boxes clear of all mechanical ductwork and piping.
- 3.3 IDENTIFICATION
- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.
 - .2 Identify splitters with size 7 nameplates.
 - .3 Identify junction and pull boxes with size 3 nameplates.
 - .4 Identify cabinets with size 5 nameplates.
- 3.4 CUSTOMER SERVICE TERMINATION ENCLOSURE
- .1 Coordinate sleeving with Utility.
 - .2 Coordinate exact location and placement with Utility.
 - .3 Coordinate metering requirements with Utility.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Common Work Results – Electrical Section 26 05 00
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 26 05 34

1.2 REFERENCES

- .1 CAN/CSA-C22.2 No. 18 – Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .2 CSA C22.1 – Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.
- .3 CSA C22.2 No. 18.1 (CSA/UL/ANCE) – Metallic Outlet Boxes.
- .4 CSA C22.2 No. 40 – Cutout, Junction and Pull Boxes.
- .5 CAN/CSA-C22.2 No. 85 – Rigid PVC Boxes and Fittings

PART 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 Sectional boxes shall not be used without specific approval of the Contract Administrator.
- .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 In moist or dusty areas, gasketed watertight or dust tight boxes and covers shall be provided.
- .7 Explosion proof in hazardous areas to suit requirements of authorities having jurisdiction.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel device boxes for flush installation, minimum size 102mm square outlet boxes with extension and plaster rings as required.
- .2 Electro-galvanized steel device boxes for flush installation in drywall and minimum size 102mm square outlet boxes with extension and square cornered tile covers as required.
- .3 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, sized as required for the installation.
- .4 102mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

- 2.5 FLOOR BOXES
- .1 Concrete tight electro-galvanized sheet steel floor boxes with gasket, floor plate, levelling screws and adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles.
- 2.6 CONDUIT BOXES
- .1 Cast FS or FD ferrous boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle where exposed to moisture.
- 2.7 MOULDED VAPOUR BARRIER BOXES
- .1 Moulded box vapour barrier: factory moulded polyethylene box complete with flange for use with recessed electric switch and outlet boxes.
- 2.8 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 32mm 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 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of Work.
 - .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6mm of opening.
 - .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
 - .5 Maintain continuity of vapor barrier where boxes are installed in exterior walls and ceilings. Use air/vapor barrier boxes for outlets installed in walls or ceilings with a vapor barrier.
 - .6 Boxes to be mounted plumb and square with building lines.
 - .7 Where outlet boxes are shown on the drawings as being “back-to-back” shall have a minimum offset of 200mm (8”) between boxes to reduce sound transmission. In no case shall “thru-wall” boxes be used.
 - .8 Install pull boxes, or fittings, in conduit runs where more than four bends are necessary.
 - .9 Install pull boxes where run exceeds 23.0 (75 feet) in length.
 - .10 All junction, outlets and pull boxes shall be so installed that they are always readily accessible.
 - .11 No power driven pins (Ramset) shall be utilized to secure boxes without specific approval from Contract Administrator.
 - .12 Check opening provided for each recessed outlet box and if it is not completely covered by cover plate, report discrepancy to the division responsible and ensure that it is rectified.

- .13 All concealed junction boxes, conduit fittings, etc., to be complete with galvanized steel covers, secured with two bolts.
- .14 Co-ordinate boxes in masonry with brick or block configuration, boxes to be saw cut in bottom of appropriate brick or block. They shall be of sufficient depth to allow conduit to pass through centre of block.
- .15 Co-ordinate locations with millwork.
- .16 Apply acoustic sealant to and seal wires penetrating moulded vapour barrier boxes.
- .17 Verify exact location of floor boxes with Contract Administrator. Adjust floor boxes level with finished floor.
- .18 Verify exact location of service fittings with furniture drawings and/or Contract Administrator. Service fittings to be installed parallel and perpendicular to building lines.
- .19 No more than two extension rings shall be used in sequence.
- .20 For installations in hazardous areas, meet all requirements of authorities having jurisdiction.
- .21 Locate raised floor outlet boxes in coordination with the City of Winnipeg's furniture. Coordinate as required.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Common Work Results - Electrical Section 26 05 00

1.2 LOCATION OF CONDUIT

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.
- .2 Produce layout sketches of conduit runs through mechanical and electrical service areas in order to pre-avoid any conflict with other construction elements and to determine the most efficient route to run conduit.

1.3 REFERENCES

- .1 CSA C22.1 – Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.
- .2 CAN/CSA-C22.2 No. 18 – Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .3 CSA C22.2 No. 45 – Rigid Metal Conduit.
- .4 CSA C22.2 No. 45.1 – Rigid Metal Conduit – Steel
- .5 CSA C22.2 No. 56 – Flexible Metal Conduit and Liquid – Tight Flexible Metal Conduit
- .6 CSA C22.2 No. 83.1 (CSA/UL) – Electrical Metallic Tubing – Steel.
- .7 CSA C22.2 No. 211.1 – Rigid Types EB1 and DB2/ES2 PVC Conduit.
- .8 CSA C22.2 No. 211.2 – Rigid PVC (Unplasticized) Conduit.
- .9 CSA C22.2 No. 211.3 (CSA/UL) – Reinforced Thermosetting Resin Conduit (RTRC) on Fittings.
- .10 CSA C22.2 No. 227.1 (CSA/UL) – Electrical Nonmetallic Tubing.
- .11 CSA C22.2 No. 227.2.1 (CSA/UL) Liquid-Tight Flexible Nonmetallic Conduit.
- .12 NFPA 70 – National Electrical Code.

PART 2 PRODUCTS

2.1 CONDUITS

- .1 Rigid galvanized steel threaded conduit.
- .2 Epoxy coated conduit: with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): with couplings. Minimum size shall be 13mm.
- .4 Rigid pvc conduit.
- .5 Flexible metal conduit and liquid-tight flexible metal conduit.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel Work.

- .3 U channel type supports for two or more conduits at 1500 mm oc. (Surface mounted or suspended).
- .4 Six mm diameter galvanized threaded rods to support suspended channels.
- 2.3 CONDUIT FITTINGS
 - .1 Fittings for raceways: to CSA C22.2 No. 18.
 - .2 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
 - .3 Factory "ells" where 90 deg. bends are required for 25 mm and larger conduits.
 - .4 Steel set screw connectors and couplings. Insulated throat liners on connectors.
 - .5 Raintight connectors and fittings complete with O-rings for use on weatherproof or sprinklerproof enclosures. Raintight couplings to be used for surface conduit installations exposed to moisture or sprinkler heads.
 - .6 Explosion proof in hazardous areas to meet requirements of authorities having jurisdiction.
- 2.4 EXPANSION FITTINGS FOR RIGID CONDUIT
 - .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 or 200 mm linear expansion.
 - .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
 - .3 Weatherproof expansion fittings for linear expansion at entry to panel.
- 2.5 FISH CORD
 - .1 Polypropylene complete with 3m spare length at each conduit end.
- 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.
 - .3 Use rigid galvanized steel threaded conduit where specified.
 - .4 Use epoxy coated conduit in corrosive areas.
 - .5 Use electrical metallic tubing (EMT) except where specified otherwise.
 - .6 Use rigid pvc conduit for underground installations.
 - .7 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures, transformers and equipment subject to vibration or movement. Provide a separate insulated grounding conductor within flexible conduit.
 - .8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
 - .9 Install conduit sealing fittings in hazardous areas, Fill with compound.
 - .10 Conduit stubs from floor slabs where exposed to damage to be rigid galvanized steel.

- .11 The conduit sizes as shown or indicated are the minimum acceptable and shall not be reduced without the approval of the Contract Administrator.
- .12 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .13 Mechanically bend steel conduit over 19 mm diameter.
- .14 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .15 Install fish cord in empty conduits.
- .16 Run a minimum of 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .17 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
- .18 Dry conduits out before installing wire.
- .19 Conduit to be sized as per Canadian Electrical Code or as shown on drawings. Note that the sizes of branch circuit conductors scheduled and/or specified on the drawings are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with Canadian Electrical Code. Where conductor sizes are increased to suit voltage drop requirements, increase the conduit size to suit.
- .20 Running threads will not be permitted; proper couplings shall be used.
- .21 Not less than 900mm (3' – 0") of flexible conduit (and of sufficient length to allow the lighting fixture to be relocated to any location within a 1.8m (6 ft.) radius) shall be used for the connection of recessed lighting fixtures. A separate drop to be used for each fixture unless fixtures are mounted in continuous rows.
- .22 No circuits fed from emergency or essential power sources shall be run in the same conduit as other systems.
- .23 Provide separate conduit system for emergency distribution.
- .24 All conduit runs passing across expansion joints of the building shall be installed utilizing approved expansion fittings, and bonding devices.
- .25 Refer to 23 05 00 for identification requirements.
- .26 All conduit systems in hazardous areas to be rigid galvanized steel to meet the requirements of the authorities having jurisdiction.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 150 mm parallel to steam or hot water lines with minimum of 75 mm at crossovers.
- .7 No power driven pins (Ramset) shall be utilized to secure any portion of the conduit.

3.3 CONCEALED CONDUITS

- .1 Do not install horizontal runs in masonry walls.
- .2 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Except with the approval of the Contract Administrator, all conduit runs embedded in concrete shall not be larger in outside diameter than one quarter (1/4) the thickness of the slab, wall, or beam in which they are embedded, nor shall they be spaced closer than three diameters on centre, nor so located as to impair unduly the strength of the construction. Where installed in columns, the conduit shall be placed in the centre of the column and then offset to the outlet box. In no case shall the conduits be placed so that there is less than 25 mm of concrete covering. All conduit runs in concrete shall be inspected and approved by Contract Administrator or his representative before concrete is poured. Conduit shall not be embedded in floating concrete slab construction unless specifically indicated otherwise.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Where conduits pass through waterproof membrane provide oversized sleeve before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.

PART 1 GENERAL

1.1 RELATED WORK

- | | | |
|----|---|------------------|
| .1 | Cast-in-Place Concrete | Section 03 30 00 |
| .2 | Common Work Results – Electrical | Section 26 05 00 |
| .3 | Conduits, Conduit Fastenings and Conduit Fittings | Section 26 05 34 |
| .4 | Wires and Cables | Section 26 05 21 |

PART 2 PRODUCTS

2.1 CABLE PROTECTION

- .1 38 x 140 mm planks pressure treated with coloured, naphthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: “cable”, “joint” or “conduit” and name of electrical system impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

PART 3 EXECUTION

3.1 DIRECT BURIAL OF CABLES

- .1 After sand bed specified in Section 31 23 16 – Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Underground cable splices not acceptable.
- .4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer’s instructions.
- .5 Maintain 150mm minimum separation between cables of different circuits. Maintain 300 mm horizontal separation between low and high voltage cables. When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position. At crossover, maintain 75mm minimum vertical separation between low voltage cables and 150mm between high voltage cables. Maintain 300mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position. Install treated planks on lower cables 0.6 m in each direction at crossings.
- .6 After sand protective cover specified is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks as indicated to cover length of run.

3.2 MARKERS

- .1 Mark cable every 150 m along cable runs and changes in direction.
- .2 Mark underground splices.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .4 Pre-acceptance Tests:
 - .1 After installing cable but before terminating, perform insulation resistance test with 1000 V megger on each phase conductor. For mineral insulated (M.I.) cable co-ordinate megger voltage rating with manufacturer.
 - .2 Check insulation resistance after each termination to ensure that cable system is ready for acceptance testing.
- .5 Acceptance Tests:
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at 100% of original factory test voltage in accordance with IPCEA recommendations.
 - .4 Leakage Current Testing.
 - .1 Raise voltage in steps from zero to maximum values as specified by IPCEA for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by IPCEA.
 - .3 Record leakage current at each step.
- .6 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test and include copies in Maintenance Manuals.
- .7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

PART 1 GENERAL

1.1 RELATED WORK

- | | | |
|----|---|------------------|
| .1 | Common Work Results - Mechanical | Section 23 05 00 |
| .2 | Common Work Results – Electrical | Section 26 05 00 |
| .3 | Conduits, Conduit Fastenings and Conduit Fittings | Section 26 05 34 |
| .4 | Wires and Cables | Section 26 05 21 |
| .5 | Outlet Boxes, Conduit Boxes and Fittings | Section 26 05 32 |
| .6 | Wiring Devices | Section 26 27 26 |

1.2 SYSTEM DESCRIPTION

- .1 Make all required electrical connections to devices, equipment, appliances, etc. furnished by other trades or the City of Winnipeg, as indicated or implied on the drawings or in the specifications.
- .2 Provide and install miscellaneous electrical components where required.

1.3 COORDINATION

- .1 Verify electrical supply characteristics of all equipment prior to rough-in. Report any discrepancies immediately. Revise wire sizing, device type, connection type, breaker size, etc., as required, to accommodate the electrical supply characteristics of the equipment supplied by other trades.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Provide all required electrical devices, components, conduits, fittings, wiring, disconnects, and miscellaneous equipment to make all connections to equipment.
- .2 Be familiar with the apparatus being supplied and carefully coordinate and cooperate with the supplier/installer to ensure a proper and complete installation.

2.2 RECEPTACLES

- .1 Where equipment has line cord and plug, ensure cap is compatible with receptacle. Provide cordsets to equipment where required.

2.3 PUSHBUTTON/BUZZERS

- .1 Provide weatherproof pushbuttons where shown.
- .2 Provide buzzers where shown.
- .3 Provide 120/24V AC transformer where required.

PART 3 EXECUTION

3.1 EQUIPMENT SUPPLIED BY OTHER TRADES

- .1 Wire and connect all equipment requiring an electrical connection. Install disconnect switches where required.
- .2 Provide a direct connection or receptacle and cord set to suit hook-up requirements of each piece of equipment. Confirm connection method with Contract Administrator.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Common Work Results – Electrical Section 26 05 00
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 26 05 34
- .3 Wires and Cables Section 26 05 21
- .4 Outlet Boxes, Conduit Boxes and Fittings Section 26 05 32
- .5 Motor and Disconnects Section 26 29 11

1.2 SYSTEM DESCRIPTION

- .1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Include motor starters, disconnects, thermostats, dehumidistats, actuators, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.
- .2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices and fittings required to provide control wiring for mechanical equipment except for temperature/humidity control systems.
- .3 Unless otherwise noted, motors and control devices shall be supplied by Division 23. Motor voltage, horsepower rating and phase ratings shall be as shown on the Division 26 drawings.

2.2 EXTERIOR EQUIPMENT

- .1 All equipment mounted on the exterior of the building shall be weatherproof.

PART 3 EXECUTION

3.1 POWER WIRING

- .1 Install power feeders, starters, disconnects and associated equipment and make connections to all mechanical equipment.
- .2 Install branch circuit wiring for mechanical systems control panels, time clocks and control transformers.
- .3 Install main power feeders to starter/control panels furnished by Division 23. Install branch circuit wiring for motors, electric coils, etc.

3.2 CONTROLS

- .1 Wire and connect remote thermostats, dehumidistats, control panels, P/E switches, etc. for furnaces, condensing units, force flows, heat recovery ventilators, electric heaters.
- .2 Wire and connect float switches, pressure switches, alternators, alarms, etc. for sump pumps, sewage pumps, domestic hot water recirculating pumps, booster pumps, jockey pumps and compressors.
- .3 Wire and connect control transformers, sensors, solenoids for auto-flush urinals, electronic faucets and wash basins.

- .4 Install, wire and connect controls which are an integral part of any packaged unit and are supplied by the trade supplying the packaged unit. Include wiring for controls for such items as air handling units, exhaust ventilators, heat recovery ventilators (HRV), etc.
- .5 Wire and connect electrical interlocks for starters supplied by Division 26.
- .6 Division 26 shall supply and install all conduit, wire, and fittings required to connect control systems. Control wiring shall be installed in conduit.
- .7 Wire and connect thermistor control devices, built-in to large motors, to motor starters as per wiring diagrams provided by Division 23.

3.3 COORDINATION

- .1 Refer to mechanical drawings for the exact location of motor control devices, and other mechanical equipment requiring an electrical connection.
- .2 Obtain full information from Division 23, regarding wiring, controls, overload heaters, equipment ratings and overcurrent protection. Notify the Division 23 subcontractor, at once, if any information provided is incorrect or unsatisfactory.
- .3 Coordinate control wiring requirements with Division 25 and provide all control wiring and connections as required to make the control systems operate as specified.
- .4 Refer to Division 23 specifications for any further electrical requirements.

3.4 SHOP DRAWING REVIEW

- .1 Review Division 23 equipment shop drawings and adjust breaker/feeder sizes as required.

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- PART 1 GENERAL**
- 1.1 RELATED WORK
- .1 Common Work Results – Electrical Section 26 05 00
- .2 Fastenings and Supports Section 26 05 29
- .3 Outlet Boxes, Conduit Boxes and Fittings Section 26 05 32
- 1.2 SUBMITTALS
- .1 Submit shop drawings and product data in accordance with Section 26 05 00.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified for approval by Contract Administrator.
- .3 Submit list of replacement lamp data for each luminaire. Include lamp type, voltage, wattage, base type and order code. Include list in maintenance manual.
- 1.3 GUARANTEE
- .1 Replace:
- .1 Incandescent and tungsten halogen lamps burnt out within 3 months of takeover.
- .2 Fluorescent and HID lamps burning out within 12 months of takeover.
- .3 Ballasts that fail or exceed their labelled noise level rating within 12 months of takeover.
- 1.4 COORDINATION
- .1 Coordinate luminaire locations with Work of other trades.
- .2 Coordinate luminaire types with ceiling finishes to ensure compatibility.
- 1.5 GENERAL
- .1 Luminaires shall carry the CSA label.
- .2 Provide supporting devices, plaster frames, junction boxes and outlet boxes where required.
- .3 Provide lenses or diffusers of glass or acrylic materials as indicated. Acrylic lenses used with fluorescent luminaires shall be a minimum of .125" (3mm) thick.
- .4 Where soffits or ceilings have thermal insulation, provide fixtures which are CSA approved for such use.
- .5 Conduct lamp burn in procedures as per manufacturer's recommendations.
- 1.6 LAMPS
- .1 Provide lamps as indicated.
- 1.7 BALLASTS AND ACCESSORIES
- .1 Provide ballasts and accessories as indicated.
- .2 Provide ballasts with non-PCB type capacitors with pressure sensitive devices to prevent rupturing.

- .3 Provide fluorescent ballasts of 120 and 347V design, automatic reset thermal protected, 90% power factor, group A noise rating. Ballasts shall be premium electronic type to meet Manitoba Hydro Power Smart requirements.
 - .4 Ballasts used in exterior luminaries shall be rated at -30°C (-20°F) starting.
- 1.8 INSTALLATION (LUMINAIRES)
- .1 Install luminaries at locations indicated, complete with all wiring, connections, fittings, hangers, aligners, box covers and accessories, as required.
 - .2 Install luminaries and lens materials in architectural details, as indicated.
 - .3 Install luminaries parallel with building lines. Wall-mounted luminaries shall be installed plumb.
 - .4 Review all ceiling type, construction details and mounting arrangements before placing luminaire orders and ensure that all mounting assemblies, frames, rings and similar features are included for and match the required installation.
 - .5 All luminaries and assemblies shall be properly secured and supported. Support luminaries independent of the ceiling construction, complete with all fasteners, framing and hangers, as may be required. Do not secure luminaries to mechanical ductwork or other vibration producing apparatus, unless specifically detailed on the drawings.
 - .6 Where a luminaire is suspended from the ceiling using a self-aligning box cover, an additional ground wire from the outlet box to the luminaire shall be provided.
 - .7 Coordinate the installation of luminaries with the Work of other trades, ensuring that the necessary depths and mounting spaces are provided. Luminaires which cannot be installed due to a conflict with structural members, pipes or ductwork shall be relocated to a more suitable location, as directed by the Contract Administrator.
- 1.9 WIRING
- .1 Connect luminaries to lighting circuits as indicated.
- 1.10 LAMPS
- .1 Adjust lamp position in adjustable lamp holder-type luminaries to produce the proper beam distribution for the specified lamp.
- 1.11 TESTS
- .1 Perform tests in accordance with Section 26 05 00
 - .2 Check luminaries and replace defective lamps, ballasts, lenses and accessories.
- 1.12 CLEANING
- .1 Prior to take-over of the project, clean the lenses and reflectors of all luminaries with a damp cloth to remove dust, smudges and fingerprints.

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- PART 1 GENERAL**
- 1.1 RELATED WORK
- .1 Common Work Results – Electrical Section 26 05 00
- .2 Conduits, Conduit Fastenings and Conduit Section 26 05 34
 Fittings
- .3 Circuit Breakers Section 26 28 21
- 1.2 SUBMITTALS
- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results –
 Electrical.
- .2 Drawings shall include electrical detail of panel, branch breaker type, quantity, ampacity
 and enclosure dimension.
- 1.3 PLANT ASSEMBLY
- .1 Install circuit breakers in panelboards before shipment.
- .2 In addition to CSA requirements, manufacturer's nameplate shall show fault current that
 panel, including breakers, has been built to withstand.
- 1.4 PANELBOARDS
- .1 Panelboards: to CSA C22.2 No. 29-M1989.
- .2 Panelboards shall be product of one manufacturer throughout project.
- .3 250V branch circuit panelboards: bus and breakers rated for 16 kA symmetrical
 interrupting capacity minimum or as indicated.
- .4 Each breaker shall be identified by permanent number identification as to circuit number.
- .5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers
 as indicated.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with full size neutral.
- .8 Flush or surface-mounted tubs as shown.
- .9 Finish trim and door baked grey enamel.
- 1.5 BREAKERS
- .1 Breakers to Section 26 28 21.
- .2 Breakers with thermal magnetic tripping in panelboards, except as indicated otherwise.
- .3 Main breaker: mounted on top or bottom of panel to suit cable entry.
- .4 Lock-on devices for 5% of 15A branch breakers installed as indicated. Turn over unused
 lock-on devices to the City.
- 1.6 EQUIPMENT IDENTIFICATION
- .1 Size 4 nameplate for each panelboard and CDP to indicate panel designation and
 voltage.

- .2 Size 3 nameplate for each breaker in CDP panelboards engraved to indicate load being supplied.
- .3 Complete circuit directory with typewritten legend showing room number and load of each circuit.

1.7 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface-mounted panelboards on U-channels. Where practical, group panelboards on common length of U-channel.
- .3 Mount panelboards to height indicated in Section 26 05 00, unless otherwise indicated.
- .4 Connect loads to circuits as indicated.
- .5 Install spare conduits from recessed panelboards in accordance with Section 26 05 34.
- .6 Connect isolated ground bus in panelboards to main building grounds source or distribution secondary neutral with #2/0 AWG, green insulated ground wire, in conduit.
- .7 Mount panelboard such that the top is 6'-0" (1.83m) finished floor.

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Common Work Results - Electrical Section 26 05 00
- .2 Outlet Boxes, Conduit Boxes and Fittings Section 26 05 32

1.2 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

- .1 CSA C22.1 – Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 42 – General Use Receptacles, Attachment Plugs and Similar Devices.
- .3 CSA C22.2 No. 42.1 – Cover Plates for Flush-Mounted Wiring Devices (Bi-National standard, with UL 5154D).
- .4 CSA C22.2 No. 55 – Special Use Switches.
- .5 CSA C22.2 No. 111 – General-Use Snap Switches (Bi-National standard, with UL 20, twelfth edition).
- .6 C22.2 No. 184 – Solid State Lighting Controls.
- .7 C22.2 No. 184.1 – Solid-State Dimming Controls (Bi-National standard with UL 1472).

PART 2 PRODUCTS

2.1 SWITCHES

- .1 Toggle operated general purpose AC Switches 15A and 20A 120Vac and 240Vac single pole, double pole, three-way and four-way switches as indicated, with the following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea molding.
 - .4 Suitable for back and side wiring.
 - .5 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

- .2 Switches of one manufacturer throughout project.
- .3 Switches to be premium specification grade.
- .4 Acceptable manufacturers:

<u>Manufacturer</u>	<u>120 Volt</u>
Hubbell	1200 Series
Bryant	4800 Series
Leviton	1200 Series
Pass & Seymour	AG-1 Series

Smith & Stone 4-4800 Series

Slater 710 Series

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 Vac, 15 A, U ground, with following features:
 - .1 Suitable for No. 10 AWG for back and side wiring.
 - .2 Break-off links for use as split receptacles.
 - .3 Double wipe contacts and rivetted grounding contacts.
- .2 Single receptacles CSA type 5-15 R, 125 VAC, 15 A, U ground with following features:
 - .1 Suitable for No. 10 AWG for back and side wiring.
 - .3 Receptacles to be orange face isolated ground type where indicated. Provide a separate insulated ground wire and a separate neutral for each isolated ground circuit.
 - .4 Receptacles of one manufacturer throughout project.
 - .5 Acceptable manufacturers: Hubbell, Arrow Hart, Bryant, Pass & Seymour, Slater. Catalogue No. 5262 for all manufacturers.
 - .6 Acceptable manufacturers for ground fault receptacles shall be:
 - .1 Arrow Hart - GF 5242
 - .2 Bryant - GFR 52FT
 - .3 Hubbell - GF 5252
 - .4 Pass & Seymour - 1591-R
 - .7 Duplex safety receptacles in public waiting areas and public lounges shall be Hubbell #SG-62.

2.3 SPECIAL WIRING DEVICES

- .1 Special wiring devices: as indicated on drawings.
- .2 Pushbutton stations to be flush or surface mounted as required. Units to be complete with up/down or start/stop buttons, as required, and green pilot light.
- .3 Range outlets to be NEMA #14-50, 125/250V, 50 Amp., black, c/w cordset.

2.4 INCANDESCENT LIGHTING DIMMER CONTROLS

- .1 Dimmer control devices to have a calibrated linear slide control lever from 0% to 100%. A separate ON/OFF switch or the bottom position of slider to have a positive OFF switch to turn off current flow to lamps.
- .2 Dimmers shall be rated at 1500, 1000 or 600 watts as required by connected load plus 20% spare capacity.
- .3 Colour of dimmer snap-on cover to be as selected by the Contract Administrator or as indicated on the drawings.
- .4 Provide a separate neutral wire for each dimmer circuit.
- .5 Approved Manufacturers
 - .1 Lutron Nova NT-1 Series

.2 Leviton Monet MN-IL Series

2.5 FLUORESCENT LIGHTING DIMMER CONTROLS

- .1 Dimmer control devices to have a calibrated linear slide control lever from 5% to 100%. A separate ON/OFF switch or the bottom position of slider to have a positive OFF switch to turn off current flow to lamps.
- .2 Colour of dimmer snap-on cover to be as selected by the Contract Administrator or as indicated on the drawings.
- .3 Provide a separate neutral wire for each dimmer circuit.
- .4 Approved ballasts: Lutron; Advance Mark X; Philips Ecotron
- .5 Approved Manufacturers:
 - .1 Lutron Nova NTF-10 series rated at 16 Amps.
 - .2 Leviton Monet MNX-IL Series.

2.6 COVER PLATES

- .1 Cover plates from one manufacturer throughout project.
- .2 Stainless steel cover plates for wiring devices mounted in flush-mounted outlet boxes to be minimum plate thickness of 1.0mm.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Cast gasketed cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .6 Weatherproof cover plates complete with gaskets for single receptacles or switches 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 specified in Section 26 05 00 or as indicated.
 - .4 Where pilot lights are required, or shown on the drawings, install flush neon pilots in outlet box grouped with associated switch.
 - .5 Study the Architectural plans and co-operate with other trades so that the location and elevation of switch outlets shall not necessitate any unnecessary cutting of dados, tile, fitments, etc. If this is not done, this Contractor will be required to move these outlets at no additional cost to the Contract. Properly locate all switches with reference to door swing, regardless of indicated position or doorswing shown on electrical drawings.
 - .6 Where finished construction of walls consist of a symmetrical pattern of finish materials, install wall switches where directed by the Contract Administrator.

- .2 Receptacles:
- .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles horizontally at height specified in Section 26 05 00 – Common Work Results - Electrical or as indicated.
 - .3 Install cordsets on ranges and dryers.
 - .4 Where switch and convenience outlets are shown close to one another, mount receptacles below and in line with the switch.
 - .5 Where finished construction of walls consist of a symmetrical pattern of wood or other panels, install and locate receptacles and switches as directed to suit the pattern.
 - .6 Suitably ground all receptacles with #12 green insulated wire to outlet box.

- .3 Coverplates:
- .1 Install suitable common cover plates where wiring devices are ganged.
 - .2 Do not use cover plates intended for flush outlet boxes on surface-mounted boxes.
 - .3 Provide a coverplate on each outlet.

3.2 IDENTIFICATION

- .1 Identify receptacles with size 1 nameplate indicating panel and circuit number. Nameplates to be mechanically fastened. Refer to Section 26 05 00 – Common Work Results - Electrical.

PART 1 GENERAL

1.1 RELATED WORK

- .1 Common Work Results – Electrical Section 26 05 00
- .2 Panelboards Section 26 24 17

1.2 SUBMITTALS

- .1 Submit product data in accordance with Section 26 05 00.
- .2 Include with requests for equal, time-current characteristics curves for breakers with ampacity of 800A and over, or with interrupting capacity of 18,000 symmetrical RMS and over at system voltage.

1.3 BREAKERS – GENERAL

- .1 Bolt-on or snap in molded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C (104°F) ambient.
- .2 Common-trip breakers with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.

1.4 THERMAL MAGNETIC BREAKERS

- .1 Molded case circuit breaker shall operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping under overload conditions and instantaneous magnetic tripping for short circuit protection.

1.5 GROUND FAULT CIRCUIT INTERRUPTERS

- .1 Molded case circuit breakers as above with integral Class A Group 1 ground fault interrupter.

1.6 MANUFACTURERS

- .1 Acceptable manufacturers: CGE, Cutler-Hammer, Schneider Canada, Seimens.

1.7 INSTALLATION

- .1 Install circuit breakers as indicated.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Telephone service provision.
- .2 Equipment and terminal backboards.
- .3 Telephone cabinets.
- .4 Premises wiring and outlets.
- .5 Firestopping Requirements
- .6 Electrical General Requirements
- .7 Conduits, Conduit Fastenings, and Conduit Fittings
- .8 Outlet Boxes, Conduit Boxes and Fittings

1.2 RELATED SECTIONS

- .1 Conduit Section 26 05 34
- .2 Wiring Devices: Telephone outlet jacks Section 26 27 26

1.3 REFERENCES (LATEST EDITION)

- .1 EIA/TIA-568 - Commercial Building Telecommunication Cabling Standard.
- .2 EIA/TIA-569 - Commercial Building Standard for Telecommunication Pathways and Spaces.
- .3 EIA/TIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications (Refer to CAN/CSA T527)
- .4 NBC National Building Code
- .5 CAN/CSA-22.1 Canadian Electrical Code, Part One
- .6 CAN/CSA-22.1 Canadian Electrical Code, Part One Section 60 “Electrical Communication Systems”
- .7 CAN/CSA-22.2 No.0-M91 General Requirements - Canadian Electrical Code, Part Two
- .8 NRC-CNRC National Building & Fire Codes of Canada
- .9 IEEE STD 1100 – 1992 IEEE Recommended Practice for Powering & Grounding Sensitive Electronic Equipment “Emerald Book”

1.4 SYSTEM DESCRIPTION

- .1 Telephone Service Entrance Pathway (existing):
- .2 Telephone Premises Wiring: Installed by MTS under directions of City of Winnipeg Corporate Information Technology (CIT). Complete installation from telephone equipment to each outlet. Contractor to supply and install wall outlet device boxes and fish cords, see telecommunication drawings.
- .3 The data horizontal cabling pathway shall consist of EMT conduit through fire separations, a J-hook system above ceiling space, and a cable tray system at the network rack.
- .4 Backbone Pathway: Conform to EIA/TIA 569 using conduit as indicated.

- .5 Horizontal Pathway: Conform to EIA/TIA 569, using raceway, backboards, and cabinets as indicated.
- .6 All backboards, cable support hardware, clamps, bonding clamps, and grounding to provide a complete system as specified.
- 1.5 PROJECT RECORD DOCUMENTS
 - .1 Submit to Section 01 33 00.
 - .2 Record actual locations and sizes of pathways and outlets for all telephone and data outlets.
 - .3 Submit five (5) sets of As-built drawings and Operation and Maintenance Manuals.
- 1.6 QUALITY ASSURANCE
 - .1 Telephone Utility: MTS. City of Winnipeg Corporate Information Technology (CIT) acceptance.
 - .2 Category 6 Data Cabling: EIA/TIA-569 - Commercial Building Standard for Telecommunication Pathways and Spaces.
- 1.7 QUALIFICATIONS
 - .1 Telephone Utility: MTS. City of Winnipeg Corporate Information Technology (CIT) acceptance.
 - .2 Category 6 Data Cabling: The Contractor performing the data cabling installation shall have a structured cabling industry affiliation such as BICSI (Building Industry Consultants International) membership, RCDD (Registered Communications Distributor Designer) and/or a structured cabling vendor certification.
 - .3 All data cabling installers shall be licensed and insured.
 - .4 The data cabling contractor shall provide references of similar projects.
- 1.8 REGULATORY REQUIREMENTS
 - .1 Provide Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.
- 1.9 MAINTENANCE SERVICE
 - .1 Provide service and maintenance of premises wiring for one year from Date of Substantial Completion.
- PART 2 PRODUCTS**
- 2.1 GENERAL
 - .1 All equipment and materials to be new CSA certified, where applicable. Equipment and materials not CSA approved shall be noted and formally submitted for approval.
 - .2 Equipment schedules are shown on the drawings.
 - .3 All telephone wiring and components from the interior building to wall jacks shall be supplied and installed by Manitoba Telecom Services (MTS) Incorporated, unless otherwise noted. City of Winnipeg, Corporate Information Technology, Communications Systems Branch shall administer and coordinate for the two types of phone systems (Local and Centrex).

2.2 TELEPHONE TERMINATION AND DATA BACKBOARDS

- .1 Material: Softwood plywood.
- .2 Size: 4' x 8' x 3/4" thick.
- .3 Qty: 1
- .4 Location: Basement Mechanical Room.
- .5 All backboards shall be rigidly secured and painted with an ASA #61 industrial gray nonconductive fire-retardant overcoat.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install polyethylene pulling string (fish cord) in each empty telephone conduit over ten feet in length or containing a bend.
- .2 Category 6 Data Cabling:
 - .1 Category 6 cabling shall be certified and tested to a minimum of 250 MHz. The Category 6 horizontal cabling shall meet the minimum technical specifications in (Telecommunications Industry Association)TIA 568A. Colour to be blue.
 - .2 All data telecommunications jacks shall be of category 6 connectors and shall be TIA certified category 6. Colour to be blue.
 - .3 No installed cabling may be exposed to view outside of the mechanical room. It shall be within conduits.
 - .4 All horizontal cabling runs shall run from each work area in a star topology to mechanical room or as shown. There shall be no connector in the cable run between the outlet in the work area and the mechanical room. All cables to be run and hung on J-hooks above ceiling to pull boxes to data jack. All exposed Category 6 cabling shall be plenum-rated.
 - .5 No cabling run may exceed a length of 300 feet.
 - .6 All Category 6 cabling shall be terminated in the mechanical room on rack mount Category 6 patch panel (maximum of 48 jacks per panel). Supply & install.
 - .7 The Category 6 cabling in the racks shall be installed with sufficient and appropriate mounting clips, brackets, and cable management to provide a secure and maintainable system. Care shall be taken to not cause the cables to be overly crimped.
 - .8 The UTP Category 6 cable tail shall be terminated with a minimum of 14" of slack but not to exceed 18".
 - .9 After dressing cable to the final location, the sheath shall be removed to a point that allows the conductors to be splayed and terminated in a neat and uniform fashion. Every effort must be made to maintain sheath integrity by removing only as much as is practical to accomplish termination. Cable pair twist shall be maintained up to the point of termination. As stated in 568A, the pairs in a cable should never be untwisted more than 0.5 inch from the point of termination. Under no circumstances shall cable pairs be untwisted or otherwise altered prior to termination.
 - .10 Any unused horizontal cabling shall be labeled and loosely coiled.
 - .11 Contractor shall specify cables proposed for use and submit documentation

proving that the proposed cables meet these specifications.

3.2 IDENTIFICATION OF EQUIPMENT

- .1 Identify equipment, receptacles, switches with nameplates and labels as follows, unless otherwise noted on drawing.
- .2 All cables shall be mechanically labelled with tag wraps or some other permanent marker capable of withstanding multiple pulling of cable through raceways. Labels shall be located 20 inches from the work area end.
- .3 All terminations shall be clearly identified on patch panels in mechanical room. All jacks in the patch panel must be in sequential order.
- .4 At each work area, faceplate outlet shall be professionally printed with jack numbers clearly visible without removing outlet faceplate. The labeling shall be metal or vinyl adhesive tape with embossed or indelible printing for each outlet.
- .5 The alpha-numeric numbering scheme is as shown:
 - .1 YY-ZZZ
 - .2 YY zone number or room number on floor
 - .3 ZZZ workstation jack number
example:
 - .4 General office 106, 1st data jack; 106-001

3.3 FIELD TEST QUALITY

- .1 The contractor shall visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Visibly damaged items shall not be installed.
- .2 Conduct cable testing only upon completion of installation.
- .3 A minimum of a Level II-E field tester shall be used to verify cabling performance.
- .4 In addition to hard copy test results, acceptable electronic format for test results are Microsoft Excel for each link.
- .5 The contractor shall describe in detail its proposed test plan to detect any defective components and to demonstrate that the installation complies with the specification.

3.4 RECORD DRAWINGS

- .1 The Contractor shall keep a record set of drawings on the site at all times recording all changes that may occur. As-built drawings are to be submitted with Contractor's name, signature and date of as-built.

3.5 CONDUIT, OUTLET BOXES AND CABLE IDENTIFICATION

- .1 Identify cable with permanent indelible identifying markings on both ends of cable.
- .2 Colour code and label conduits, boxes, and cables. Paint at points where conduit enters wall, ceiling, or floor and at 8 feet intervals.
- .3 Colours: $\frac{3}{4}$ " wide x 4" long
 - Telephone green (label "TELEPHONE")
 - Data blue (label "DATA")
- .4 Colour outlet box covers and label "TELEPHONE" or "DATA" to colour designated and show circuit numbers in black felt markers on inside of covers.

3.6 CONDUIT

- .1 Rigid galvanized steel threaded conduit.
- .2 Electrical Metallic Tubing (EMT) with couplings and plastic end bushings. Minimum size shall be $\frac{3}{4}$ ".

3.7 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 2 inches and smaller. Two-hole steel straps for conduits larger than 2 inches.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 U-channel type supports for two or more conduits at 5 feet O/C. Surface mount or suspended as close as possible to surface.
- .4 Support to suspended channel shall be 6mm diameter galvanized threaded rod.

3.8 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90 degree bends are required for 1 inch and larger conduits.
- .3 Steel set screw connectors and couplings. Insulated throat liners on connectors.

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 All drawings and all sections of these specifications apply to and form an integral part of this section.
- .2 Intrusion detection devices.
- .3 Alarm control panel.
- .4 Signaling devices.
- .5 Building monitoring devices.

1.2 RELATED SECTIONS

- .1 Section 08 71 00 - Door Hardware - General.
- .2 Section 26 05 00 - Common Work Results –Electrical
- .3 Section 26 05 34 – Electrical – Conduits, Conduit Fastening, and Control Fittings

1.3 WORK INCLUDED

- .1 Existing security system components (motion detectors, door contacts) dangling from building structure and hard-wired shall not be disconnected, unless new construction requires rerouting of wire. In this case disconnect component, route existing wire through new construction and reconnect motion detector and temporary fastened above new ceiling space for reinstallation by-others. The alarm control panel and remote station signal transmitter located in the basement mechanical room shall not be disturbed.
- .2 New remote building monitoring system: supply and install two temperature sensors, float level switch and dry contacts for all smoke/CO detectors, to Johnson Controls – Controller Panel Assembly, see Communication drawing. Wiring shall be in EMT and home run connected to Controller Panel Assembly.
- .3 Johnson Controls – Controller Panel Assembly NAE 5510-0 to be supplied by City of Winnipeg – Building Services Division. This includes transformer, controller, modem and UPS. Contractor is responsible to accommodate space and provide 120V power supply to Controller Panel Assembly NAE 5510-0, see telecommunication drawing. Installation, termination and setup of system are by City of Winnipeg – Building Services Division.
- .4 NFPA 72G - Notification Appliances for Protective Signaling Systems.
- .5 NFPA 72H - Guide for Test Procedures for Protective Signaling Systems.

1.4 SYSTEM DESCRIPTION

- .1 The facility has an existing security system (PROTELEC).
- .2 A new building monitoring system (Johnson Controls) shall be installed to remotely monitor basement space temperature, main floor space temperature, and sump pit high water level and fire/CO alarm.
- .3 Intrusion Detection System: Protect building and selected areas from intrusion during SECURE hours as follows:
 - .1 Exterior Windows: Existing motion detectors to be relocated, see telecommunication drawing.
 - .2 Exterior Doors: Existing door contacts (to be relocated, see telecommunication drawing) and new door contacts (by-others) for new Lift Vestibule exterior door.

- 1.5 SUBMITTALS
 - .1 Submit to Section 01 33 00.
 - .2 Shop Drawings: Indicate system wiring diagram showing each device and wiring connection required.
 - .3 Product Data: Provide electrical characteristics and connection requirements.
 - .4 Test Reports: Indicate satisfactory completion of required tests and inspections.
 - .5 Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- 1.6 PROJECT RECORD DOCUMENTS
 - .1 Submit to Section 01 33 00.
 - .2 Record actual locations of initiating devices, signaling appliances, and end-of-line devices.
- 1.7 OPERATION AND MAINTENANCE DATA
 - .1 Submit to Section 01 33 00.
 - .2 Operation Data: Operating instructions.
 - .3 Maintenance Data: Maintenance and repair procedures.
- 1.8 QUALIFICATIONS
 - .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience, and with service facilities within 100 miles of Project.
- 1.9 REGULATORY REQUIREMENTS
 - .1 Provide Products listed and classified by UL as suitable for purpose specified and indicated.
 - .2 Conform to requirements of above requirements and drawings.
- PART 2 PRODUCTS**
- 2.1 MANUFACTURERS
 - .1 As per drawings.
 - .2 Substitutions: Refer to Section 01 61 00.
- 2.2 ALARM CONTROL PANEL
 - .1 Control Panel (existing): Modular construction with surface wall-mounted enclosure.
 - .2 Power supply (existing): Adequate to serve control panel modules, remote detectors, remote annunciators, relays, and alarm signalling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours.
 - .3 System Supervision (by-others): Provide electrically-supervised system, with supervised alarm initiating and alarm signaling circuits. Component or power supply failure places system in alarm mode.
 - .4 Initiating Circuits (by-others): Supervised zone module with alarm and trouble indication.

- .5 Signal Circuits (by-others): Supervised zone coded signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode and does not disable that circuit from transmitting alarm.
 - .6 Remote Station Signal Transmitter (existing): Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.
 - .7 Auxiliary Relays (by-others): Provide sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.
 - .8 Occupied/Unoccupied Selector (by-others):
 - .9 Entry and Exit Time Delays (by-others):
 - .10 Trouble Sequence of Operation (by-others):
 - .11 Alarm Sequence of Operation (by-others): Actuation of intrusion detecting device places system in alarm mode, which causes the following operations:
 - .1 Sound and display local alarm signaling devices with non-coded signal.
 - .2 Transmit zone-coded signal to central station.
 - .3 Indicate location of actuated device on control panel and on remote annunciator panel.
 - .4 Zone Bypass Switch (by-others):
 - .5 Keyed Bypass Switch (by-others):
 - .6 Alarm Reset (by-others): Key-accessible reset function resets alarm system out of alarm if alarm initiating circuits have cleared.
 - .7 Audible Alarm Sequence (by-others):
 - .8 Lamp Test (by-others): Manual lamp test function causes alarm indication at each zone at control panel and at annunciator panel.
- 2.3 INITIATING DEVICES
- .1 Proximity Switch (by-others):
 - .2 Motion Detector (by-others):
 - .3 Photoelectric Detector (by-others):
- 2.4 SIGNAL DEVICES
- .1 Alarm Bells (by-others): NFPA 72G, electric vibrating, bell with operating mechanism behind dome. Sound Rating: 81dB at <10 feet.
 - .2 Remote Annunciator (by-others): Provide supervised remote annunciator including audible and visual indication of intrusion by zone, and audible and visual indication of system trouble. Install in surface wall-mounted enclosure.
- PART 3 EXECUTION**
- 3.1 INSTALLATION
- .1 Install to manufacturer's instructions.
 - .2 Use 18 AWG minimum size conductors for detection and signal circuit conductors. Install wiring in conduit.
 - .3 Make conduit and wiring connections to door hardware devices provided under Section

08 71 00.

PART 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-95, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-98, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A3000-98-A5-98, Portland Cement.
 - .2 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.

1.2 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: any solid material in excess of 0.25 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Unsuitable materials:
 - .1 Weak and compressible materials under excavated areas.
 - .2 Frost susceptible materials under excavated areas.

.3 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.

.2 Table

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

.3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.7 Un-shrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.3 SUBMITTALS

.1 Samples:

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Inform Contract Administrator at least 4 weeks prior to commencing Work, of proposed source of fill materials and provide access for sampling.

1.4 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where Consultant/Engineer is employee of Contractor, submit proof that Work by Consultant/Engineer is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to commencing Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified professional Engineer who is registered or licensed in Province of Manitoba, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

1.5 PROTECTION OF EXISTING FEATURES

- .1 Protect existing features in accordance with applicable local regulations.
- .2 Existing buried utilities:
 - .1 Size, depth and location of existing utilities as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Prior to commencing excavation Work, notify Contract Administrator or authorities having jurisdiction, establish location and state of use of buried utilities

and structures. City of Winnipeg or authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

- .3 Confirm locations of buried utilities by careful test excavations.
- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities encountered
- .5 Where utility lines exist in area of excavation, obtain direction of Contract Administrator before removing / re-routing.
- .6 Record location of maintained, re-routed and abandoned underground lines.
- .7 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing surface features:
 - .1 Conduct, with Contract Administrator, condition survey of, trees and other plants, lawns, fencing, service poles, wires, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing surface features from damage while Work is in progress. In event of damage, immediately make repair to approval of Contract Administrator.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1, CAN/CGSB-8.2.
 - .3 Table

<u>Sieve Designation</u>	<u>% Passing</u>	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

PART 3 EXECUTION

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 STOCKPILING

- .1 Stockpile fill materials in areas designated by Contract Administrator. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

3.3 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Contract Administrator's approval details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in manner not detrimental to public and private property, or any portion of Work completed or under construction.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

3.4 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Excavation must not interfere with bearing capacity of adjacent foundations.
- .3 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .4 For trench excavation, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .5 Keep excavated and stockpiled materials a safe distance away from edge of trench.
- .6 Restrict vehicle operations directly adjacent to open trenches.
- .7 Dispose of surplus and unsuitable excavated material in approved location on site or off site.
- .8 Do not obstruct flow of surface drainage or natural watercourses.
- .9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

- .10 Obtain Contract Administrator's approval of completed excavation.
- .11 Remove unsuitable material from trench bottom to extent and depth as directed by Contract Administrator.
- .12 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with fill concrete.
 - .2 Fill under other areas with fill compacted to not less than 95 % of corrected maximum dry density. Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Contract Administrator.
- 3.5 FILL TYPES AND COMPACTION
 - .1 Use fill of types as indicated.
- 3.6 BEDDING AND SURROUND OF UNDERGROUND SERVICES
 - .1 Place and compact granular material for bedding and surround of underground services as indicated.
 - .2 Place bedding and surround material in unfrozen condition.
- 3.7 BACKFILLING
 - .1 Do not proceed with backfilling operations until Contract Administrator has inspected and approved installations.
 - .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
 - .3 Do not use backfill material which is frozen or contains ice, snow or debris.
 - .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
 - .5 Backfilling around installations.
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Contract Administrator or:
 - .2 If approved by Contract Administrator, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Contract Administrator.
 - .6 Compaction: compact each layer of material to densities noted on drawing or in geotechnical report.
 - .1 In trenches:
 - .1 Up to 300mm above pipe or conduit: sand placed by hand.

- .2 Over 300 mm above pipe or conduit: native material approved by Contract Administrator.
- .2 Under seeded and sodded areas: use site excavated material to bottom of proposed topsoil levels except in trenches and within acceptable distances of foundation.
- .3 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

3.8 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Contract Administrator.
- .2 Replace topsoil as directed by Contract Administrator.
- .3 Clean and reinstate areas affected by Work as directed by Contract Administrator.
- .4 Provide temporary plating to support traffic loads over excavated areas where maintenance of access is required as requested by Contract Administrator.

PART 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .5 ASTM D1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .6 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.2 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and stockpile aggregates in accordance with Section 32 11 24 – Granular Sub-Base.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Granular base: material in accordance with Section 32 11 24 – Granular Sub-Base and following requirements:
 - .1 Liquid limit: to ASTM D4318, maximum 25
 - .2 Plasticity index: to ASTM D4318, maximum 6
 - .3 Los Angeles degradation: to ASTM C131. Max. % loss by weight: 45
 - .4 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136.

Passing		Retained on
50 mm	to	25 mm
25 mm	to	19.0 mm
19.0 mm	to	4.75 mm

- .5 Soaked CBR: to ASTM D1883, min 80, when compacted to 100% of ASTM D1557.

PART 3 EXECUTION

3.1 SEQUENCE OF OPERATION

- .1 Place granular base after sub-base surface is inspected, proof rolled and approved by Contract Administrator.
- .2 Placing
 - .1 Construct granular base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Begin spreading base material on crown line or on high side of one-way slope.
 - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Contract Administrator may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment
 - .1 Compaction equipment to be capable of obtaining required material densities.
- .4 Compacting
 - .1 Compact to density as specified in Section 31 23 16 – Excavating, Trenching and Backfilling.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Contract Administrator.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.2 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Contract Administrator.

PART 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D422-63(1998), Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Granular sub-base material: in accordance with Section 32 11 23 – Granular Base and following requirements:
 - .1 Other Properties as follows:
 - .2 Liquid Limit: to ASTM D4318, Maximum 25.
 - .3 Plasticity Index: to ASTM D4318, Maximum 6.
 - .4 Los Angeles degradation: to ASTM C131. Max% Loss by mass: 40.
 - .5 Soaked CBR: to ASTM D1883, Min 40 when compacted to 100% of ASTM D1557.

PART 3 EXECUTION

3.1 PLACING

- .1 Place granular sub-base after subgrade is inspected, proof rolled and approved by Contract Administrator.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.

- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Contract Administrator may authorize thicker lifts (layers) if specified compaction can be achieved.
- .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .9 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density as specified in Section 31 23 16 – Excavating, Trenching and Backfilling.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Contract Administrator.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

- .1 Finished sub-base surface to be within [10] mm of elevation as indicated but not uniformly high or low.

3.4 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Contract Administrator.

PART 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D698-91 (1998), Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.2-98, Boiled Linseed Oil.
 - .2 CAN/CGSB-3.3-99, Kerosene.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Concrete mixes and materials: to Section 03 30 00 - Cast-in-Place Concrete.
- .2 Reinforcing steel: to Section 03 20 00 - Concrete Reinforcement.
- .3 Joint filler, Curing Compound: to Section 03 30 00 - Cast-in-Place Concrete.
- .4 Granular base: to Section 31 23 16 - Excavating, Trenching and Backfilling.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.
- .6 Fill material: to Section 31 23 16 - Excavating, Trenching and Backfilling.
- .7 Boiled linseed oil: to CAN/CGSB-1.2.
- .8 Kerosene: to CAN/CGSB-3.3.

PART 3 EXECUTION

3.1 GRADE PREPARATION

- .1 Do grade preparation work in accordance with Section 31 23 16 - Excavating, Trenching and Backfilling.

3.2 GRANULAR BASE

- .1 Obtain Contract Administrator's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base to at least 95% SPMDD.

3.3 CONCRETE

- .1 Obtain Contract Administrator's approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.

- .4 Provide edging as indicated with 10 mm radius edging tool.
- .5 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Contract Administrator can be demonstrated.
- 3.4 TOLERANCES
 - .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.
- 3.5 EXPANSION AND CONTRACTION JOINTS
 - .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5 m.
 - .2 Install expansion joints as indicated at intervals of 6 m.
 - .3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.
- 3.6 ISOLATION JOINTS
 - .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
 - .2 Install joint filler in isolation joints in accordance with Section 03 30 00 - Cast-in-Place Concrete as indicated.
 - .3 Seal isolation joints with approved sealant.
- 3.7 CURING
 - .1 Cure concrete by adding moisture continuously in accordance with CAN/CSA-A23.1 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by approved curing compound.
 - .2 Where burlap is used for moist curing, place two pre-wetted layers on concrete surface and keep continuously wet during curing period.
 - .3 Apply curing compound evenly to form continuous film. In accordance with manufacturer's requirements.
- 3.8 BACKFILL
 - .1 Allow concrete to cure for 7 days prior to backfilling.
 - .2 Backfill to designated elevations with approved material. Compact and shape to required contours as indicated.
- 3.9 LINSEED OIL TREATMENT
 - .1 After concrete has cured for specified curing time and when surface of concrete is clean and dry, apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters.
 - .2 Linseed oil mixture to consist of 50% boiled linseed oil and 50% mineral spirits by volume.
 - .3 Apply treatment when air temperature above 10 deg C.
 - .4 Apply first coat at 135 mL/m².
 - .5 Apply second coat at 90 mL/m² when first coat has dried.

PART 1 GENERAL

1.1 RELATED WORK

- .1 See City of Winnipeg Standard Construction Specifications.

1.2 GENERAL

- .1 This specification shall cover the supply and installation of trees, shrubs and other plants, including planting beds as shown on the Drawings.
- .2 The Contractor shall furnish all labour, materials, equipment and services necessary, including all things necessary for and incidental to the satisfactory performance and completion of the Work as specified herein.

1.3 SOURCE QUALITY CONTROL

- .1 Obtain approval from the Contract Administrator of plant material at source prior to digging.

1.4 PROTECTION

- .1 Coordinate shipping of nursery stock and excavation of holes to ensure minimum time laps between digging and planting.
- .2 Tie branches of nursery stock securely, and protect plants against abrasion, exposure and extreme temperature changes during transit. Avoid binding of plants with rope or wire, which could damage bark, break branches, or destroy the natural shape of the plant.
- .3 Give full support to root ball of nursery stock during lifting.
- .4 Cover plant foliage with tarpaulin, and protect bare roots by means of dampened straw, peat moss, saw dust or other acceptable material to prevent loss of moisture during transit and storage.
- .5 Remove broken and damaged roots with sharp pruning sheers. Make clean cuts, and cover cuts over 10 mm diameter with a tree wound dressing.

PART 2 PRODUCTS

2.1 PLANTING BEDS AND PLANTING SOIL

- .1 Planting depth shall be 300 mm unless otherwise stated.
- .2 Soil shall be as specified in City of Winnipeg Standard Construction Specifications.

2.2 PLANT MATERIAL

- .1 Plant material shall be as specified on the Plant Specification List on the Landscape Plan. All sizes shown are minimum. Plant form, habit, etc., shall be in accordance with the most recent Canadian Nursery Landscape Association (CNL) publications.
- .2 Quality and source are to comply with the Canadian Standards for Nursery Stock, Seventh Edition of CNLA referring to size and development of plant material and root ball. Measure trees when branches are in their natural position. Height and spread dimensions refer to main body of trees and not from branch top to branch top. Use trees of No.1 grade unless specified as multi-stem. Trees are to have only one, sturdy, reasonably straight and vertical trunk, and a well-balanced crown with fully developed leader. Evergreens are to be full and bushy to grade with single leader only. Height o be measured to previous year's growth.

- .3 Trees and shrubs are to be free of disease, insect infestation, rodent damage, sun scald, frost cracks, abrasions, unhealed scars, scars exceeding 5 cm in diameter, major forks or crooks in the trunk, broken branches or angled leaders. Bare root is not acceptable. Plants having the above defects will not be accepted by the Contract Administrator.
 - .4 Nursery stock is to be grown in nurseries under proper cultural practices as recommended by the Canadian Nursery Trades Association. Only nursery stock grown for at least the last four (4) years in nurseries located in an Agriculture Canada Plant Hardiness Zone of 2 (a or b) or 3 (a or b) will be accepted. Nursery stock that has grown in Plant Hardiness Zones of 1 & 4 or greater will be rejected.
- 2.3 WATER
- .1 Water is to be potable and free of minerals, which may be detrimental to plant growth.
- 2.4 FERTILIZER
- .1 Fertilizer is to be a slow release formulation of low nitrogen and high phosphorus e.g. 10-50-12. apply quantities at rates stated by product manufacturer.
- 2.5 TREE SUPPORTS
- .1 Stakes: T-bar, steel, 38 x 38 x 5 x 2440 mm.
 - .2 Wire tightener: Turnbuckle, galvanized steel, 9.5 mm diameter with 270 mm length.
 - .3 Guying Wire: 3 mm diameter multi-wire steel cable.
 - .4 Clamps: U-bolt, galvanized, 13 mm diameter c/w curved retaining bar and hex nuts.
 - .5 Anchors: Wood, 38 x 67 x 600 mm.
 - .6 Guying collar: Tube, plastic, 13 mm diameter, nylon reinforced.
- 2.6 TRUNK PROTECTION
- .1 150 mm diameter Corrugated Plastic Pipe 300 mm height.
- 2.7 LANDSCAPE FABRIC
- .1 'Weedpro' Or Acceptable Equal.
- 2.8 DRAINAGE MATERIALS
- .1 100 mm diameter 'Big O' flexible pipe complete with filter cloth sock.
 - .2 Clean pea stone.
 - .3 100 mm diameter PVC pipe set vertically, complete with screw cap at top.
- 2.9 MULCH
- .1 Wood chip mulch: Local shredded wood chip mulch. 75 mm depth around all trees and in shrub beds as indicated on Landscape Plan.
 - .2 Samples must be supplied for approval prior to installation. No debris permitted.
- PART 3 EXECUTION**
- 3.1 INSTALLATION
- .1 Trees and shrubs are to be planted according to the Landscape Plan and planting details.
 - .2 Location of nursery stock will be staked out or painted on Site by the Contractor in consultation with the Contract Administrator.

- .3 The Contractor shall coordinate operations, keeping the Site clean and the planting holes drained. The Contractor shall immediately remove soil or debris spilled onto street pavement, grass or sidewalk.
 - .4 Installation shall be done during periods of suitable weather conditions and in accordance with locally accepted practice. Trees are to be planted within forty-eight (48) hours of excavation from the nursery. No tree pit is to be left open at the end of the Contractor's workday. The planting program is to be planned to ensure that trees delivered to the Site at designated planting locations are installed and thoroughly watered the same day as delivery.
 - .5 Plant trees and shrubs vertically. Orient plants to give best appearance in relation to structures, roads and sidewalks. Place nursery stock to depth equal to depth they were originally growing in the nursery. With balled and burlapped root balls and root balls in wire baskets, loosen burlap and cut away the top 1/3 without disturbing the root ball. Do not pull burlap or rope from under the root ball. Non-biodegradable wrapping must be removed. Tamp planting soil around the root system in layers of 150 mm, eliminating air voids. Frozen or saturated planting soil is unacceptable. When 2/3 of planting soil has been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling.
 - .6 Each tree is to have an earth saucer at its base having a diameter as large as the excavation with a 100 mm lip formed at the perimeter of the saucer to retain water. When planting is completed, give surface of planting saucer dressing of fertilizer and mix fertilizer thoroughly with top layer of planting soil and water in well.
 - .7 Tree Supports
 - .1 All trees shall be staked or guyed with 3 guy wires and anchors, to acceptable horticultural practices and satisfaction of the Contract Administrator.
 - .8 Pruning
 - .1 All new and existing deciduous and coniferous trees shall be pruned. The amount of pruning shall be limited to the minimum necessary to remove dead or injured branches. Pruning shall be done in such a manner as to preserve the natural character of the plants. Leaders shall not be removed. Only clean, sharp tools shall be used. All cuts shall be clean and flush, leaving no stubs. Cuts, bruises or scars on the bark shall be traced back to living tissue and removed. The affected areas shall be shaped so as not to retain water and all cuts of more than 25 mm in diameter shall be painted with approved tree paint.
 - .2 All pruning to be done by an individual with a Manitoba Arborist License.
- 3.2 DAMAGE TO EXISTING STRUCTURES AND PROPERTY AND SERVICES AND UTILITIES
- .1 Further to GC:17, all necessary precautions shall be exercised by the Contractor so as not to remove, disturb, or damage any existing trees, shrubs, sod, pavements, streets, roads, boulevards, poles, hydrants, water pipes, gas pipes, electrical wires, cables, conduits, sewers or other existing facilities and equipment at the Site of the Work. For all damage incurred thereto in the performance of the Work, the Contractor shall upon instructions from and to the satisfaction of the Contract Administrator, either replace and repair such damage, whichever may be deemed necessary in the opinion of, and acceptable to, the Contract Administrator. The cost of which shall be borne entirely by the Contractor. The Contractor shall also indemnify and save harmless the City from all claims made directly or indirectly against it in respect to any such damage.
 - .2 The Contractor's operations shall be limited to the minimum area necessary for undertaking the Work and he shall be responsible for all damage resulting from his Work

on private property. The Contractor shall take such measures as are necessary to ensure safe and convenient pedestrian ingress and egress is maintained to private properties while he is working near them. Any damage caused by the negligence of the Contractor or his Sub-contractors to the adjacent Works or properties, shall be promptly repaired by him at his own expense, to the satisfaction of the Contract Administrator.

.3 EXISTING SERVICES AND UTILITIES

.1 No responsibility will be assumed by the City for correctness or completeness of the Drawings, when provided, with respect to the existing utilities, pipes or other objects either underground or on the surface; the City shall not be liable for the incorrectness and inadequacy thereof. It shall be the responsibility of the Contractor to determine the location of all such utilities, pipes and other objects and to make good any damage done to them.

3.3 PROTECTION OF EXISTING TREE

.1 The Contractor shall take the following precautionary steps to prevent damage from construction activities to existing trees within the limits of the construction area:

.1 Trees greater than 100mm diameter or trees identified to be at risk by the Contract Administrator are to be strapped with 25x100x2440 wood planks, or suitable protected as approved by the Contract Administrator. Do not use nails or other fasteners that penetrate the tree trunk. The width and length of strapping may be reduced to suit the tree being protected as approved by the Contract Administrator.

.2 Excavation shall be performed in a manner that minimizes damage to the existing root systems. Where possible, excavation shall be carried out such that the edge of the excavation shall be a minimum of 1.5 times the diameter (measured in inches), with the outcome read in feet, where 1 inch diameter equals 1 foot measured from the outside edge of the trunk of the tree at 6 inches above grade. Where roots must be cut to facilitate excavation, they shall be pruned neatly at the face of excavation.

.3 Operation of equipment within the drip line of the trees shall be kept to a minimum required to perform the Work required. Equipment shall not be parked, repaired, refuelled; construction materials shall not be stored, and earth materials shall not be stockpiled within the drip lines of trees. The drip line of a tree shall be considered to be the ground surface directly beneath the tips of its outermost branches. The Contractor shall ensure that the operations do not cause flooding or sediment deposition on areas where trees are located.

.4 Repair, replace and maintain tree protection materials during construction until such time no equipment will be working in the area.

.5 Remove safety fencing and strapping material without harming the trees as soon as the construction and restoration Work is complete.

.2 Obtain approval from the Contract Administrator to excavate within 2.0 metres of a tree.

.3 Excavate in a manner to minimize damage to the tree root systems. Keep exposed roots in excavations and trenches moist or shaded. If stockpiling of excavated soil material is required, stockpile in areas away from the tree roots if possible.

.4 Prune exposed roots with equipment such as trencher, chain saws, root cutters or other methods acceptable to the Contract Administrator in a manner that will leave a neat, clean root end.

- .5 Take precautions to ensure tree limbs overhanging the Work area are not damaged by construction equipment. Contact the Contract Administrator for consultation or pruning of overhanging or damaged limbs and branches and other unanticipated problems with trees during the construction of the Works.
- .6 All damage to existing trees caused by the Contractor's activities shall be repaired to the requirements and satisfaction of the Contract Administrator. Damages must be repaired by an Individual with a Manitoba Arborist License.

3.4 MAINTENANCE PERIOD

- .1 Substantial Performance shall be achieved once all materials are in place. The Contractor shall maintain the plant material for one (1) year after the completion of the installation.
- .2 Water plantings sufficiently and regularly to maintain optimum growth and health of plants without causing erosion. For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
- .3 Remove weeds using control methods acceptable to the Contract Administrator.
- .4 Maintain tree guards, guy wires, and wrappings in proper repair.
- .5 Replace or re-spread damaged, missing, or disturbed mulch. Maintain proper mulch depths.

3.5 ACCEPTANCE

- .1 Total Performance shall be granted at the end of the maintenance period.

3.6 WARRANTY PERIOD

- .1 The Warranty/Maintenance period of one (1) year shall commence at Total Performance. Plant material that is replaced during the maintenance period shall be of the same size, calliper and species as the original plant material unless otherwise agreed to, in writing, by the Contract Administrator. Plant material that is replaced will receive an additional 1 year Warranty/Maintenance period, which will commence on the date of replacement.

PART 1 GENERAL

1.1 REFERENCES

- .1 Excavation, backfilling and site grading

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Course filter aggregate: to CSA A23.1-1973, Table 3, Group 1, 19.0 to 4.75mm.
- .2 Fine filter aggregate: to CAN3-A23.1M77, Table 1.
- .3 Perforated pipe: 150mm Diameter
- .4 Solid Pipe: 150mm Diameter ABS
- .5 Filter Fabric:
 - .1 Synthetic Fibre: Rot proof, unaffected by action of oil or saltwater and not subject to attack by insects or rodents.
 - .2 Fabric: needle punch construction supplied in rolls of minimum 3m width, 20m length and minimum weight of 240g/m².
 - .3 Seams: Welded in accordance with manufacturers recommendations.
 - .4 Physical Properties:
 - .1 Breaking load and elongation: to ASTM D1682-62 (1975) Grab test method 25mm square jaws, constant rate of travel 300mm/min.
 - .1 Stronger principal direction 600N
 - .2 Weaker principal direction 400N
 - .3 Seam strength 90% of tensile.
 - .4 The product of tensile strength times percent elongation at rupture shall be greater than 55 000N%
 - .2 Permeability: 0.10 cmm/s

PART 3 EXECUTION

3.1 INSPECTION

- .1 Check graded sub-grade for conformity with elevations and cross sections before placing filter bed material.
- .2 Check for unstable areas and areas requiring additional compaction.
- .3 Notify Contract Administrator of unsatisfactory conditions.
- .4 Do not begin installation of foundation drainage until deficiencies have been corrected, unless otherwise directed by Contract Administrator.

3.2 INSTALLATION

- .1 Pipe Bedding:
 - .1 Cut trenches in sub-base and place 100 mm thickness of coarse filter aggregate and tamp to grade.

- .2 Pipe Laying:
 - .1 Wrap pipes in filter cloth.
 - .2 Install plastic pipe and fittings to CGSB41-GP-29M and as shown on drawings.
 - .3 Ensure pipe interior and coupling surfaces are clean before laying.
 - .4 Lay perforated pipe to slope of 10mm per m or as indicated. Face perforations and coupling slots downward.
 - .5 Do not use concrete, masonry, stones, wood, or any type of shim to establish pipe slope.
 - .6 Connect pipes using manufacturers recommended fittings.
 - .7 Protect pipe ends from damage and ingress of foreign material at the end of each work day or work stoppage.
 - .8 Connect pipes to sumps by appropriate adapters manufactured for this purpose.
- .3 Filter bed backfill:
 - .1 Place filter bed after pipe installation
 - .2 Place 150 mm thickness minimum of coarse filter aggregate on each side of perforated pipe and 300mm of coarse filter aggregate on top of perforated pipe. Place 150mm of fine filter aggregate over top and to the sides coarse filter aggregate.
 - .3 Place filter bed by hand in 150mm lifts. Consolidate by tamping lightly. Prevent displacement of pipe.

3.3 TESTING

- .1 Do not backfill any drain lines until they have been inspected and approved by the City and authorities having jurisdiction. Open test holes shall be left at the high points of drain lines prior to commencement of backfilling. The drain system shall be tested by allowing a continuous flow of water from a hose outlets entering lines at high points. Drainage flow shall be inspected at low points where the lines discharge as indicated on drawings or as directed. If the flow at the discharge points is insufficient, the tile lines shall be inspected and corrected to ensure a proper flow.

3.4 CLEANOUTS

- .1 Provide flush cleanouts in all un-perforated pipes immediately inside exterior foundation walls, grade beams, slabs at connections between non-perforated /perforated tile, at all corners and at 15m maximum lengths O.C. along straight runs, unless otherwise indicated.