



THE CITY OF WINNIPEG
BILL AND HELEN NORRIE LIBRARY
15 POSEIDON BAY

TENDER NO. 390-2023

SPECIFICATIONS

ISSUED FOR CONSTRUCTION: MAY 26, 2023

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Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 78 00 – Closeout Submittals.
- .2 Section 01 79 00 – Demonstration and Training.

1.2 REFERENCES

- .1 National Building Code of Canada (NBCC) 2015.
- .2 National Fire Protection Association (NFPA).

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- .1 The *Bill and Helen Norrie Library Additional Site Water Remediation and Repair Work* project consists of scope of work to address on site excessive amounts of water found in hydrogeological report as a result of existing crawlspace sump pumps discharging more than normal water amounts per day. New repair work for this project will address work both in the crawlspace and on site to address more than normal groundwater conditions and repair any damages incurred through this site condition.
- .2 Construct project in accordance with contract documents including project manual and project drawings for Architectural, Mechanical and Electrical disciplines. Contractor and Subcontractors are responsible for co-ordination between trades. Distribution of documents by Contractor to their Subcontractors does not absolve Contractor or their Subcontractors from provisions stated in Division 01 – General Requirements of contract or co-ordination between parties.
- .3 Part D – Supplemental Conditions, Part C – General Conditions for Construction, and Division 01 – General Requirements sections apply to technical specification sections found in Project Manual.

1.4 CODES AND STANDARDS

- .1 Work to meet or exceed requirements of applicable standards, building code, fire code and other codes and referenced documents. In event of conflict between any provisions of authorities, most stringent provision applies.
- .2 Safety of Work: perform work in accordance with current National Building Code of Canada and other applicable regulations and requirements of other authorities having jurisdiction.
- .3 Fire Safety: comply with National Fire Protection Association (NFPA) codes and standards for fire safety.
- .4 Construction Safety:
 - .1 Observe and enforce construction safety measures required by Canadian Construction Safety Code, Provincial Government Worker’s Compensation Board, Workplace Safety and Health Act, Municipal Statutes and Authorities having jurisdiction.

1.5 SETTING OUT OF WORK

- .1 Before commencing work, contact utility companies to establish location and extent of existing utility or service lines in area of work. Be absolutely certain of their origin and destination.
 - .1 When breaking into or connecting to existing services or utilities, execute work at times directed by local governing authorities, with minimum of disturbance to work, and/or building.
 - .2 Protect, relocate or maintain existing active services.

- .3 Cap off services, when indicated, in manner approved by authority having jurisdiction.
- .4 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .5 Record location of services in accordance with Section 01 78 00.
- .2 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
 - .1 Provide devices needed to lay out and construct work.
 - .2 Supply stakes and other survey markers required for laying out work.

1.6 DEMONSTRATION AND TRAINING

- .1 Be responsible to provide comprehensive demonstration and training program to the City's personnel on operation and maintenance of Contractor supplied and installed equipment and systems in accordance with Section 01 79 00.

1.7 PLANNING OF WORK

- .1 Upon award of contract, immediately commence off-site work (preparation of shop drawings, ordering of materials, preparation of requested documents, etc.). On-site work is expected to commence as soon as possible upon award of contract. Co-operate with the City in scheduling work.
- .2 Plan work to ensure that emergency access and egress required by the City and by the authorities having jurisdiction are maintained, and all life safety and building occupancy requirements of all applicable codes and regulations are in force for construction areas and adjacent floor areas.

1.8 ACCESS TO WORK

- .1 Allow the City, Contract Administrator or both access to work, or other places where work is being fabricated in connection with contract for purposes of inspection and examination of workmanship and materials.
- .2 Maintain safety helmets on job site, ready for use, to be used in compliance with Workplace Safety and Health regulations.

1.9 BUILDING PERMIT

- .1 The Owner shall pay for the building permit. The Consultant shall apply for the building permit on behalf of the Owner prior to bid closing. Upon award of Contract, the building permit shall be transferred to and become the responsibility of the Contractor.
- .2 Consultant will apply for foundation permit in advance of full permit.

1.10 NO SMOKING POLICY

- .1 Fully co-operate, respect and comply with Smoke-Free Workplace policy requirements established by the City throughout its facilities. Smoking is not permitted anywhere within the City's facilities or on the City's property.
- .2 Smoke-free workplace policy applies to everyone who works in workplace and to visitors.
- .3 During full term of contract, ensure that Contractors' employees, Subcontractors and Suppliers, performing work on site on Contractors' behalf, are instructed to comply with Smoke-Free Workplace policy requirements.

1.11 NO ENTERTAINMENT DEVICES

- .1 Fully co-operate, respect, and comply with the City's request that no entertainment devices (e.g. portable radios, stereos, MP3 players, etc.) will be played on site at any time by Contractor's work force or sub-contractors.

1.12 OCCUPANCY BY THE CITY

- .1 The City has right to enter and occupy building in whole or in part before substantial performance of work provided that, in opinion of Consultant, such entry and occupancy does not prevent or interfere with Contractor in completion of contract.
- .2 Such occupancy by the City is not considered as acceptance of work and will not relieve Contractor from responsibility to complete contract or as acknowledgement of fulfillment of terms of contract.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Alternate Prices.
 - .1 Alternate Price: a price required by this Section, to be added or deducted from the Stipulated Price (Bid Price) for the specified alternate work. Include all costs for co-ordination of the related work and modify surrounding work as required to complete the project under each alternate.

1.2 ALTERNATE PRICES

- .1 Alternate Price No. 1.
 - .1 Base Bid Price: Installation of new interior weeping tile as indicated on drawing A1.0
 - .2 Alternate Price: Delete installation of new interior weeping tile.
- .2 Alternate Price No. 2.
 - .1 Base Bid Price: Regrading of east back patio pavers as indicated on drawing L-CN1.
 - .2 Alternate Price: Delete regrading of east back patio regrading.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 01 78 00 – Closeout Submittals.

1.2 CONSTRUCTION SCHEDULE

- .1 Refer to D24 – Job Meetings, in Supplemental Conditions.
- .2 Affix copy of construction schedule to wall of construction office during construction period and keep up to date and reviewed at each progress meeting.

1.3 START-UP MEETING

- .1 After award of Contract, but before start of Work, convene a start-up meeting to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of the Consultant, the City, Contractor, major Subcontractors are to attend.
 - .1 Agenda:
 - .1 Appointment of official representatives of participants in the work.
 - .2 Schedules of work, progress scheduling.
 - .3 Schedule of submission of shop drawings, product data, samples, test reports,
 - .4 Schedule for provision of mock-ups and field samples.
 - .5 Requirements for temporary utilities, temporary barriers and controls, construction facilities, site sign and other temporary construction.
 - .6 Record drawings.
 - .7 Maintenance Manuals.
 - .8 Take-over procedures, acceptance, warranties.
 - .9 Monthly progress claims, administrative procedures, holdbacks.
 - .10 Sustainable requirements.
 - .11 Commissioning.
 - .3 Establish time and location of meeting and notify all concerned parties within five (5) Working Days of meeting.
 - .4 Chair meeting, record minutes, and distribute minutes to all attending parties within four (4) Working Days after meeting.

1.4 CONSTRUCTION PROGRESS MEETINGS

- .1 Schedule and administer project meetings once every week throughout progress of work. Provide physical space for meetings.
- .2 Contractor, Subcontractors involved in work, Consultant and the City are to be in attendance.
- .3 Person attending meetings to be empowered to act on behalf of organizations they represent.
- .4 Prepare agenda and record minutes of meetings and circulate to attending parties and affected parties not in attendance within four (4) days after meeting.
- .5 Meeting agenda to include following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Significant proceedings and decisions. Identify action by parties.
 - .5 Problems which impede construction schedule.

- .6 Review of off-site fabrication delivery schedules.
- .7 Corrective measures and procedures to regain projected schedule.
- .8 Revision to construction schedule.
- .9 Progress schedule, during succeeding work period.
- .10 Review submittal schedules: expedite as required.
- .11 Maintenance of quality standards.
- .12 Review proposed changes for effect on construction schedule and on completion date.
- .13 Construction Safety.
- .14 New business.

1.5 ON-SITE DOCUMENTS

- .1 Maintain at job site, one copy of each of following:
 - .1 Contract Drawings.
 - .2 Project Manual
 - .3 Addenda
 - .4 Reviewed shop drawings
 - .5 Proposed change notices
 - .6 Change orders
 - .7 Other modifications to contract
 - .8 Field test reports
 - .9 Copy of approved work schedule
 - .10 Manufacturers' installation and application instructions

1.6 JOB LOG

- .1 Keep permanent, written record on site of progress of work. Make record available for inspection by Consultant and the City. Show dates of commencement and completion of all trades and parts of work, particulars regarding daily weather conditions, changes in work, field instructions, major deliveries, as well as number of employees of various trades involved.

1.7 REQUEST FOR INTERPRETATION PROCESS

- .1 General:
 - .1 Immediately on discovery of the need for interpretation of the Contract Documents, Contractor shall prepare and submit an RFI to the Consultant in the form specified.
 - .2 Consultant will return RFIs submitted to Consultant by other entities controlled by Contractor with no response. The RFI will then be considered closed.
 - .3 Co-ordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
 - .4 For RFIs submitted electronically, include project name and RFI number in subject line of email.
- .2 Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - .1 Project name (including building number).
 - .2 Project number.
 - .3 Date.
 - .4 Name of Contractor.
 - .5 Name of Consultant.
 - .6 RFI number, numbered sequentially. (eg: RFI-001)
 - .7 RFI subject.
 - .8 Specification Section number, title and related paragraphs, as appropriate.
 - .9 Drawing number and detail references, as appropriate.
 - .10 Field dimensions and conditions, as appropriate.

- .11 Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Price, Contractor shall state impact in the RFI.
- .12 Contractor's signature.
- .13 Attachments: Include sketches, descriptions, measurements, photos, product data, shop drawings, co-ordination drawings, and other information necessary to fully describe items needing interpretation.
 - .1 Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- .3 RFI Forms: Contractor generated form including all content indicated in this Section.
 - .1 Form and attachments shall be electronic files in PDF format.
- .4 Consultant's Action: Consultant will review each RFI, determine action required, and respond. Allow ten (10) Working Days for Consultant's response for each RFI. RFIs received by Consultant after 1:00 p.m. will be considered as received the following working day.
 - .1 The following Contractor-generated RFIs will be returned without action:
 - .1 Requests for approval of submittals.
 - .2 Requests for approval of substitutions.
 - .3 Requests for approval of Contractor's means and methods.
 - .4 Requests for approval of corrective actions for deficient work.
 - .5 Requests for co-ordination information already indicated in the Contract Documents.
 - .6 Requests for adjustments in the Contract Time or the Contract Sum.
 - .7 Requests for interpretation of Consultant's actions on submittals.
 - .8 Incomplete RFIs or inaccurately prepared RFIs.
 - .2 Consultant's action may include a request for additional information, in which case Consultant's time for response will date from time of receipt of additional information.
 - .3 If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Consultant in writing within 10 days of receipt of the RFI response. Failure to notify will result in the work being included as part of the contract.
- .5 RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log with progress meeting minutes. Include the following:
 - .1 Project name.
 - .2 Name and address of Contractor.
 - .3 Name and address of Consultant.
 - .4 RFI number including RFIs that were returned without action or withdrawn.
 - .5 RFI description.
 - .6 Date the RFI was submitted.
 - .7 Date Consultant's response was received.
- .6 On receipt of Consultant action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Consultant within ten (10) Working Days if Contractor disagrees with response.

1.8 LIFE SAFETY TESTING

- .1 Refer to the City of Winnipeg Life Safety Tests in Buildings document. Arrange and carry out life safety test with City of Winnipeg in accordance with this document. Provide all necessary management and co-ordination. Arrange all necessary involvement from sub-trades. Prepare test procedures and submit for review six (6) weeks prior to test date.
- .2 Arrange and carry out pre-'dry run' tests and submit written confirmation to Consultant that test has adhered to procedures and that the system is correctly operating.
- .3 Arrange and conduct 'dry run' tests which will mimic the full life safety test. 'Dry run' test shall be conducted in presence of Contractor and Consultant only.

- .4 Create procedures to demonstrate the operation of the life safety system. Procedures shall include, but shall not be limited to:
 - .1 Emergency and exit lighting including measurements where applicable.
 - .2 Operation of emergency power system.
 - .3 Operation of fire alarm including demonstration of all controls and interfaces with other systems including, but not limited to operation of smoke control systems, fire pump and security systems.
- .5 Demonstrate all systems under normal and essential power modes.
- .6 Tests shall not commence until fire alarm system is verified and free of all defects. Submit final verification report to consultant five (5) working days prior to life safety test for review.
- .7 Provide all fuel, personnel, communications equipment and attendance required.

1.9 SUBTRADE AND SUPPLIERS LIST

- .1 Submit within three (3) Working Days after contract award, all addresses, phone, email, and name of person in charge of subtrades and suppliers used on this project.

1.10 CONSTRUCTION PHOTOGRAPHS

- .1 Maintain and submit to Consultant visual record of construction progress in following formats:
- .2 Use digital camera with capability of producing digital images at minimum 5.0 megapixels, uncompressed, saved in *.tif format.
- .3 Copy (burn) each set of images onto a Windows formatted CD-Rom disc.
- .4 Identify each CD disc with name and number of project, date of exposure, set number.
- .5 Pre-Construction Photographs
 - .1 Provide photographs of existing site and surface features prior to start of construction work.
 - .2 Allow for approximately 25 images for each set.
 - .3 Number of sets required: one.
 - .4 Viewpoints:
 - .1 Panoramic view of site from each compass point.
 - .2 Close ups of specific site details and surface features in locations as determined by Consultant.
- .6 Construction Progress Photographs
 - .1 Provide photographs of construction during progress of the work, including site features.
 - .2 Allow for approximately 50 images for each set.
 - .3 Number of sets required (frequency): provide one set monthly with progress statement, plus one set of additional photograph as specified below.
 - .4 In addition to monthly progress images provide additional sets of photographs for:
 - .1 Completion of major elements of the Work such as:
 - .1 Main floor construction.
 - .2 Structural framing.
 - .3 Mechanical and electrical services before concealment.
 - .2 During installation of specific elements of the Work, as determined by Consultant, including but not necessarily limited to:
 - .1 City Furnished Products (CFP).
 - .2 Major elements of interior work.
 - .5 Number of viewpoints: interior and exterior viewpoints including close ups of specific details, in locations as determined by Consultant.

- .7 Photographs of Mock Up Rooms
 - .1 Provide photographs of each fully completed mock up room specified in Section 01 11 00.
 - .2 Number of sets required: one for each mock-up room.
 - .3 Allow for approximately 25 images of each set.
 - .4 Number of viewpoints:
 - .1 Each interior elevation, including finishes on walls, floors and ceilings.
 - .2 Mechanical and electrical service outlets (gas, vacuum, switches, etc.)
 - .3 Equipment.
 - .4 Close ups of specific details and features, in locations as determined by Consultant.

- .8 Final Photographs
 - .1 Number of sets required: one.
 - .2 Allow for approximately 100 images for each set.
 - .3 Number of viewpoints:
 - .1 Exterior elevations of each building.
 - .2 Interior of rooms and finishes as determined by Consultant. Allow for approximately ten (10) photographs of each room.
 - .3 Close ups of specific details as determined by Consultant.
 - .4 Locations of viewpoints as determined by Consultant.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 31 00 – Project Management and Co-ordination.
- .3 Section 01 78 00 – Closeout Submittals.

1.2 ADMINISTRATIVE

- .1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence so as not to 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. Work affected by submittals to proceed only after review is complete.
- .2 Do not proceed with Work affected by submittal 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 Consultant. Stamp and sign submittals certifying review of submission. This review represents that necessary requirements have 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 considered rejected.
- .6 Notify Consultant, 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 is co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant review of submittals.
- .9 Contractor's responsibility for deviation in submission from requirements of Contract Documents is not relieved by Consultant review.
- .10 Keep one reviewed copy of each submission on site.

1.3 REQUEST FOR INTERPRETATION PROCESS

- .1 Contractor shall prepare and submit an RFI in accordance with Section 01 31 00.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data provided by Contractor to illustrate details of portion of work.
- .2 Shop drawings that do not include the stamp, date, and signature of the person responsible for reviewing the shop drawings before submittal to the Consultant, will be rejected and returned without being examined.
- .3 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, Canada where specifically requested in the specifications. Shop drawings not bearing the required Engineer's stamp will be rejected and returned without being examined.

- .4 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 co-ordinated, regardless of section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .5 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of shop drawings for each requirement requested in specification sections and as the Consultant may reasonably request.
- .6 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.
- .7 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF) of test reports for requirements requested in specification Sections and as requested by Consultant.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within three (3) years of date of contract award for project.
- .8 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of certificates for requirements requested in specification Sections and as requested by Consultant.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract, complete with project name.
- .9 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of manufacturers' instructions for requirements requested in specification Sections and as requested by Consultant.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .10 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .11 Allow minimum of ten (10) Working Days for Consultant's review of each submission or a reasonable longer period of time for large or complex submissions.
- .12 For Contractors' use in preparation of drawings required under contract, Contractors may obtain from Consultant, electronic AutoCAD drawing files subject to following:
 - .1 Removal by Consultant of Consultants' professional seals from electronic drawing file; and
 - .2 Receipt of Licence Agreement prepared by Consultant and signed by Contractor(s) or user(s) of electronic files; and
 - .3 Receipt of payment to Consultant from each separate Contractor requesting an electronic drawing file, an amount of \$250.00 for first electronic file or drawing sheet requested plus an additional \$200.00 for each subsequent electronic file or drawing sheet requested at same time.
- .13 Adjustments made on shop drawings by Consultant are not intended to change contract price. If adjustments affect value of work, state such in writing to Consultant prior to proceeding with work.

- .14 Make changes in shop drawings as Consultant may require, consistent with contract documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.
- .15 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 samples.
 - .5 Other pertinent data.
 - .6 Identify on each shop drawing the related specification section (number and title) for which the product/material applies.
- .16 Submissions to include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of Subcontractor, Supplier, 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, relation to adjacent structure or materials.
 - .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 Relation to adjacent structure or materials.
- .17 After Consultant's review, distribute copies to subtrades as required.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copy 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.
- .21 No extension of Contract Time will be allow for delays in the Work which may be caused for Consultant's rejection of shop drawings.
- .22 Shop drawings which contain deviations from the Contract Documents which are not presented to the Consultant in writing, will rejected and returned without being examined.

1.5 SAMPLES

- .1 Submit samples for review as requested in respective specification sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Consultant's business address.
- .3 Notify Consultant 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 Consultant are not intended to change contract price. If adjustments affect value of work, state such in writing to Consultant prior to proceeding with work.
- .6 Make changes in samples which Consultant may require, consistent with contract documents.
- .7 Reviewed and accepted samples will become standard of workmanship and materials against which installed work will be verified.

1.6 MOCK-UPS

- .1 Erect mock-ups in accordance with Section 01 45 00.

1.7 CONSTRUCTION PHOTOGRAPHS

- .1 Submit construction photographs in accordance with Section 01 31 00.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 31 00 – Project Management and Co-ordination.
- .3 Section 01 33 00 – Submittal Procedures.

1.2 REVIEW AND INSPECTION OF THE WORK

- .1 Refer to C11 Inspection of General Conditions for Construction.

1.3 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Consultant for purpose of inspecting and/or testing portions of work as identified in specification sections, and be paid for by cash allowance.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relieve Contractors of their responsibility to perform work in accordance with contract documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Contractor to correct defect and irregularities as advised by Consultant, at no cost to the City, and pay costs for retesting and re-inspection.

1.4 ACCESS TO WORK

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

1.5 PROCEDURES

- .1 Notify appropriate agency 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.

1.6 REPORTS

- .1 Submit four (4) copies of inspection and test reports promptly to the Consultant.
- .2 Provide copies to Subcontractor of work being inspected/tested and manufacturer/fabricator of material being inspected/tested.

1.7 TESTS AND MIX DESIGNS

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

1.8 MOCK-UPS AND SAMPLE WORK

- .1 Prepare mock-ups and sample work specifically requested in specifications.
- .2 Construct mock-ups and sample work at locations acceptable to Consultant.
- .3 Prepare mock-ups and sample work for Consultant's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in work.
- .4 Failure to prepare mock-ups and sample work in ample time is not considered sufficient reason for an extension of contract time and no claim for extension by reason of such default will be allowed.
- .5 Unless noted, approved mock-ups and sample work may remain as part of work.
- .6 When reviewed and approved, mock-ups and sample work become standard of workmanship, appearance, and materials approved for similar areas throughout project.

1.9 MILL TESTS

- .1 Submit mill test certificates as required of the specification Sections and as may be requested.

1.10 EQUIPMENT AND SYSTEMS

- .1 Submit four (4) copies of adjustment and balancing reports for mechanical, electrical building equipment and systems.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 31 00 – Project Management and Co-ordination.
- .3 Section 01 61 00 – Common Product Requirements.
- .4 Section 01 74 00 – Cleaning and Waste Management.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA).
 - .1 CSA O121-08 (R2013), Douglas Fir Plywood.
 - .2 CAN/CSA S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.
 - .3 CAN/CSA Z321-96 (R2006), Signs and Symbols for the Workplace.

1.3 TEMPORARY WORK

- .1 Temporary Electricity and Lighting.
 - .1 Provide and pay for temporary power required during construction for temporary lighting and the operating of power tools.
 - .2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.
 - .3 Temporary power for electric cranes and other equipment requiring in excess of the supply required for temporary lighting and power tools is the responsibility of Contractor.
 - .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
 - .5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than three (3) months.
 - .6 All permanent fluorescent, metal halide, and LED lighting utilized for temporary lighting shall have 100 hours continuous burn in time.
 - .7 Turn over a minimum of 5% of fluorescent and metal halide lamps at end of project. Submit to Consultant for his review and approval a list of each type of lamp and their quantities prior to turn over.
 - .8 Clean permanent lights after final painting and flooring is complete in each room or area.
 - .9 Be responsible for co-ordination of any required utility disruption or relocation.
- .2 Temporary Fire Protection.
 - .1 Provide and maintain temporary fire protection equipment during performance of work required by insurance companies having jurisdiction, and governing codes, regulations and bylaws.
- .3 Temporary Heating and Ventilation.
 - .1 Arrange, pay for, operate and maintain temporary heat and ventilation and shelters used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment to keep work that requires protection from cold adequately warm and sheltered from elements.
 - .1 Acceptable temporary heaters to consist of warm forced air type, operated in well ventilated location and vented to exterior.

- .2 Use of direct-fired heaters discharging waste products into work areas will not be permitted.
- .3 Provide protection on floors and adjacent surfaces to prevent damage.
- .2 Temporary heating and ventilation, shelters, fuel and fuel storage: satisfactory to authorities having jurisdiction.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of work.
 - .2 Protect work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health requirements for safe working environment.
- .4 Maintain minimum temperature of 10°C (or higher where specified) during construction.
- .5 Ventilating.
 - .1 Prevent hazardous accumulations of dust, fumes, mists, vapours or gasses in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after completion of work to assure removal of harmful contaminants.
- .6 Maintain strict supervision of temporary heating and ventilating equipment to:
 - .1 Conform to applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .7 Be responsible for damage to work due to failure in providing adequate heat and protection during construction.
- .4 Permanent HVAC Heating Systems
 - .1 Permanent HVAC heating systems of buildings may be used for temporary heating during construction subject to the requirements specified in Section 23 05 01, Section 01 81 19, or other requirements listed throughout the specifications.
 - .2 Pay for utility charges at prevailing rates.
 - .3 Permanent HVAC systems may be used only after the following criteria are met:
 - .1 Consultant has provided written authorization to use HVAC systems.
 - .2 Building shell is closed in (exterior walls and roofs are fully insulated complete with air/vapour barriers; exterior doors, windows, and curtain walls are installed with glazing).
 - .3 Major elements of interior work is complete including, but not necessarily limited to, taping and sanding of gypsum board.
 - .4 Major dust generating activities are complete.

- .5 Temporary Telephone Service.
 - .1 Arrange, pay for and maintain temporary telephone service used during construction in accordance with authorities having jurisdiction. Provide at least one phone in Contractor's field office available for use by the City, Contractor, Subcontractors and Consultants.
- .6 Temporary Digital Co-ordination.
 - .1 Provide on-site lap top computer with internet access and digital camera to permit emailing of correspondence and photos of construction issues to Consultant(s) for prompt co-ordination and response.
- .7 Temporary Water Supply.
 - .1 Arrange, pay for and maintain temporary water supply used during construction in accordance with authorities having jurisdiction.
 - .2 Arrange for connection with appropriate utility company as required and pay costs for installation, maintenance and removal.

1.4 CONSTRUCTION FACILITIES

- .1 Contractor Site Offices
 - .1 Provide office heat, lighted and ventilated, of sufficient size to accommodate site meetings and furnished with drawing lay down table.
 - .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
 - .3 Subcontractors may provide their own offices as necessary. Direct location of these offices.
 - .4 Offices within building:
 - .1 When usable space is available within the project building and if approved by the the City, the site office may be located within the building, utilizing rooms therein.
 - .2 Such areas may be used contingent upon there being no delay in completion of the work and there being no damages to material or finishes.
 - .5 Personal Protective Equipment:
 - .1 Provide and store within site office personal protective equipment for use of the City's personnel visiting the site.
 - .2 Provide twelve (12) each of the following:
 - .1 Hard hats.
 - .2 Protective eyewear (eyeglass type – not goggles for sanitary reasons).
 - .3 Earmuff hearing protection. Ear plugs are not acceptable for sanitary reasons.
 - .4 Hi-Visibility Safety vests.
 - .5 Safety shoes – either rubber boots with steel toes or strap-on type steel toe guards. Provide in several adult shoe sizes.
- .2 Consultant's Site office
 - .1 Provide temporary site office for Consultant.
 - .2 Consultant's office shall be separate from the Contractors Site Office and may be in the same trailer/building but must have its own separate, lockable, entrance.
 - .3 Inside dimensions minimum 3.6 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with four (4) 50% opening windows and one lockable door.
 - .4 Insulate building and provide heating system to maintain 22°C inside temperature at - 20°C outside temperature.
 - .5 Finish inside walls and ceiling with plywood or wallboard and paint in selected colours, or finish with prefinished hardboard. Finish floor with 19 mm thick plywood.

- .6 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10% upward light component.
- .7 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory, and mirror and maintain supply of paper towels and toilet tissue.
- .8 Equip office with 1 x 2 m table, four (4) chairs, 6 m of shelving 300 mm wide, one (1) three drawer filing cabinet, one (1) plan rack and one (1) coat rack and shelf.
- .9 Maintain in clean condition. Provide periodic housekeeping.
- .3 Construction Equipment, Tool, and Material Storage.
 - .1 Refer to Section 01 61 00.
 - .2 Provide and maintain, in clean orderly condition, adequate lockable, weather tight trailers for storage of materials, tools, and equipment which are subject to damage by weather. Co-ordinate location(s) with the City.
 - .3 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
 - .4 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.
- .4 First Aid.
 - .1 Provide and maintain clearly marked and fully stocked first-aid case in readily available location.
- .5 Sanitary Facilities.
 - .1 Provide sufficient sanitary facilities for work force in accordance with authorities having jurisdiction.
 - .2 Keep area and premises in sanitary condition. Service sanitary facilities at least weekly and more frequently if required.
 - .3 Post notices and take such precautions as required by local health authorities.
 - .4 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Consultant.

1.5 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide and maintain adequate access to project site.
- .2 Build and maintain temporary roads, sidewalk crossings, ramps, and construction runways to maintain access, and snow removal during period of Work.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
- .4 Conform to requirements of governing authorities when required and, when necessary, make arrangements with adjacent property owners.
- .5 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.
- .6 Maintain access to property including overhead clearances for use by emergency response vehicles.
- .7 Limited parking will be permitted on site, in locations designated by the City, and provided it does not disrupt performance of Work.
- .8 Provide snow removal during period of Work.

1.6 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect adjacent private and public property from damage during the performance of work.
- .2 Be responsible for all damage incurred.

1.7 CONSTRUCTION AIDS

- .1 Construction Hoists and Cranes.
 - .1 Provide, operate and maintain hoists and cranes required for moving of works, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
 - .2 Operate hoists and cranes using qualified personnel.
- .2 Scaffolding and Platforms.
 - .1 Construct and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs in rigid, secure and safe manner in accordance with CAN/CSA S269.2.
 - .2 Erect scaffolding and platforms independent of walls. Remove promptly when no longer required.

1.8 TEMPORARY BARRIERS AND ENCLOSURES

- .1 Site Enclosure.
 - .1 Erect temporary site enclosure to separate construction area from adjacent streets, property, and to protect public, workers, public and private property from injury or damage. At a minimum, provide chain link fence 2.4 m high minimum. Provide lockable gates as require for access to site by workers and vehicles.
 - .2 Provide snow fencing or other similar barriers around trees, natural features, bench marks, utility lines, etc. designated to remain. Protect from damage.
- .2 Weather Enclosures.
 - .1 Provide temporary weather tight enclosures and protection for exterior openings until permanently enclosed.
 - .2 Erect enclosures to allow access for installation of materials and working inside enclosure.
 - .3 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
 - .4 Design enclosures to withstand wind pressure and snow loading.
- .3 Protection of Building Finishes and Equipment.
 - .1 Provide protection for finished and partially finished building finishes and equipment during the performance of work.
 - .2 Provide necessary screens, covers and hoardings.
 - .3 Confirm locations and installation with Consultant at least 3 days prior to installation.
 - .4 Be responsible for damage incurred due to lack of or improper protection.
- .4 Site Storage and Over Loading.
 - .1 Refer to Section 01 61 00.
 - .2 Confine Work and operations of workforce to limits indicated by Contract Documents. If Work must be performed in another area, notify and obtain permission from the City.
 - .3 Do not unreasonably encumber site with material or equipment.
 - .4 Move stored products or equipment interfering with operations of the City.
 - .5 Do not load or permit to be loaded any part of Work with weight or force that will endanger Work.

- .6 Obtain and pay for use of additional storage or work areas needed for operations or for delivered equipment or materials not required immediately on site.
- .7 Repair all existing site conditions damaged by use of site to match pre-construction conditions.
- .5 Guard Rails and Barricades.
 - .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stairwells, open edges of floors and roofs.
 - .2 Construct in accordance with requirements of authorities having jurisdiction.
- .6 Security Measures.
 - .1 In addition to requirement herein, provide hoarding and enclosures of sufficient strength and dimension to prevent unauthorized entry of all persons.
 - .2 Maintain at site, at all times, names and telephone numbers of all Contractor's and Subcontractor's representatives, available to hand for use in event of need for immediate response in emergency situations.

1.9 TEMPORARY CONTROLS

- .1 Dewatering.
 - .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water while work is in progress.
 - .2 Dispose of water in accordance with Section 01 74 00 and in manner not detrimental to public and private property, or any portion of work completed or under construction.
- .2 Shoring, Underpinning and Bracing.
 - .1 Conduct condition survey, including photographs of adjacent buildings before commencing excavation and investigate foundations to determine underpinning, etc., required.
 - .2 Take every precaution against any movement or settlement of existing and new construction, utilities, streets, paving, walks, lighting standards, piping, conduit, etc.
 - .3 Engage services of qualified professional engineer with demonstrated competence in work, registered in Province of Manitoba to design and inspect shoring, bracing and underpinning as required for work.
 - .1 Submit design and supporting data at least two (2) weeks prior to commencing work.
 - .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered in Province of Manitoba.
 - .4 Provide bracing, shoring, sheeting, sheet piling, underpinning and other retaining structures as required by aforementioned engineer and authorities having jurisdiction to assure horizontal and vertical support of adjacent areas.
 - .5 Assume responsibility for strength, adequacy, safety, and support of retaining structures, utilities, etc. with respect to any movement, settlement or drainage; liability for injury resulting from inadequate shoring, bracing, and underpinning; responsibility for repair of damage caused.

1.10 SITE SIGNS AND NOTICES

- .1 Site Signs and Notices: signs and notices for safety or instruction to be in English language, or commonly understood graphic symbols to CAN/CSA Z321.
- .2 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Consultant.

- .3 Maintain sign in clean condition throughout duration of project.
- .4 No other signs or advertisements, other than warning signs, are permitted on site, except by specific written permission by the City.
- .5 Signs and notices for safety and instruction shall be in both official languages Graphic symbols shall conform to CAN3-Z321.
- .6 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Consultant.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 31 00 – Project Management and Co-ordination.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 01 50 00 – Temporary Facilities and Controls.
- .4 Section 01 74 00 – Cleaning and Waste Management.

1.2 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Procedures for product substitution.
- .3 Manufacturer's instructions.
- .4 Quality of Work, co-ordination and fastenings.
- .5 Co-ordination:
 - .1 Contractor shall co-ordinate the exact location of mechanical and electrical fixtures, outlets, switches, panels, etc. which are located in architectural wall and ceiling finishes (e.g. linear wood ceilings) with Consultant prior to rough-in and cutting of openings and recesses.
 - .2 Contractor shall be responsible for all costs associated with relocation of mechanical and electrical devices (including replacement of damaged wood veneer paneling, linear wood ceilings and other architectural finishes) resulting from failure to co-ordinate with Consultant prior to rough-in.

1.3 LABOUR AND PRODUCTS

- .1 Products, material and equipment used to contain no asbestos fibre.

1.4 REFERENCE STANDARDS

- .1 B8 – Substitutes, of the Bidding Procedures.
- .2 Within text of each specifications section, reference may be made to reference standards.
- .3 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .4 If there is question as to whether any product or system is in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.
- .5 Cost for such testing will be born by the City in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .6 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.

1.5 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays in any items. If delays in supply of products are foreseeable, notify Consultant 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 Consultant at commencement of work and should it subsequently appear that work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in contract price or contract time.

1.6 QUALITY AND CONFORMANCE

- .1 When material or equipment is specified by standard or performance specifications, upon request of Consultant, obtain from manufacturer an independent testing laboratory report, stating that material or equipment meets or exceeds specified requirements.
- .2 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.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should any dispute arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 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.

1.7 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, contamination, 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 seals 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 as specified in Section 01 50 00.
- .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 construction materials 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 Consultant.
- .9 Touch-up damaged factory finished surfaces to Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name plates.
- .10 Cleaning and Waste Management in accordance with Section 01 74 00.

1.8 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of work.
- .2 Transportation costs of products supplied by the the City will be paid for by the City, unless specified otherwise. Unload, handle and store such products, unless otherwise specified.

1.9 MANUFACTURER'S INSTRUCTIONS

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

1.10 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 Consultant if required work is such as to make it impractical to produce required results.
- .2 Enforce discipline and good order among workers.
- .3 Do not employ anyone unskilled in their required duties. Consultant reserves right to require dismissal from site, workers deemed incompetent or careless.
- .4 Decisions as to standard or fitness quality of work in cases of dispute rest solely with Consultant, whose decision is final.

1.11 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Ensure Work of various Subcontractors does not conflict or create interference.
- .3 Be responsible for the proper co-ordination and placement of openings, sleeves, and accessories.
- .4 Supply all items required to be built in as and when required, together with templates, measurements and shop drawings.
- .5 Ensure all workers examine the drawings and specifications covering the Work of others that may affect the performance of their own Work. Examine the Work of others and report to the Consultant, in writing, any defects, or deficiencies that may affect the Work. In the absence of any report, the Contractor shall be held to have waived all claims for damage to or defects in such Work.
- .6 Ensure that components requiring foundations or openings that are required for the installation of Work is co-ordinated. Furnish the necessary information to the Sections concerned in ample time to permit allowance for such items. Failure to comply with this requirement does not relieve the party at fault of the cost of cutting or drilling at a later date and subsequent patching.
- .7 Electrical Subcontractor shall prepare interference co-ordination drawings, in accordance with Section 01 33 33, showing all major feeders, conduits, and central junction boxes for review by Consultant prior to rough-in.

- .8 Extras to the Contract where architectural, structural, or mechanical work requires relocation or modifications due to the failure of the Electrical Subcontractor to co-ordination the work and provide interference co-ordination drawings will not be accepted.

1.12 CONCEALMENT

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

1.13 REMEDIAL WORK

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

1.14 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate. Consultant may move these up to 3m from position indicated, at no cost to the City, provided notice is given before related work has commenced.
- .2 Inform Consultant of conflicting installation. Submit field drawings to indicated relative position of various services and equipment when required by Consultant. Install as directed.
- .3 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.
- .4 The locations of all mechanical and electrical devices mounted in the following locations to be co-ordinated with Consultant before commencing installation of service rough-ins and cutting of openings for outlets, fixtures and equipment.
 - .1 Stone veneer walls.
 - .2 Quartz surfaced walls.
 - .3 Plastic-laminate faced wood paneled walls and ceilings.
 - .4 MDF paneled walls and ceilings.
 - .5 Linear wood ceilings.
- .5 Contractor shall be responsible for all costs associated with relocation of mechanical and electrical devices (including replacement of damaged stone veneer cladding and wood paneling) resulting from failure to co-ordinate with Consultant prior to rough-in.

1.15 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 request 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 minimum, space evenly and install neatly.

- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.16 FASTENINGS - EQUIPMENT

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

1.17 PROTECTION OF WORK IN PROGRESS

- .1 Protect Work completed or in progress.
- .2 Prevent overloading of any part of the building. Do not cut, drill, or otherwise sleeve any load bearing structural member unless specifically indicated on drawings or in Specifications without written approval of the Consultant.

Part 2 Products

2.1 PRODUCT OPTIONS

- .1 Products specified by reference standards or by description only: any product meeting those standards or description is acceptable for use.
- .2 Products specified by naming one or more manufacturers: submit request for substitution for any manufacturer not named.

2.2 SUBSTITUTIONS

- .1 Refer to Section 01 33 00 and B8 – Substitutes, of Bidding Procedures.
- .2 The Work is based on the Materials and methods specified in the specifications.
- .3 Should substitutions be required because of unavailability the Consultant will consider proposals to substitute specified products/materials with alternate products/materials.
- .4 Substitutions are not allowed unless application has been made to and prior approval has been granted by the Consultant in writing.
- .5 Each proposal must:
 - .1 Include sufficient information in the form of product data, specifications, drawings, and other manufacturer's data to enable the Consultant to properly evaluate the proposal.
 - .2 Identify changes required in the applicable Work which would become necessary to accommodate the substitute.
- .6 The Consultant reserves the right to accept or reject any proposal without prejudice for any reason whatsoever and reserves the right to disclose or not to disclose their reasons for such rejection.

- .7 In submittal of a request for substitution it is hereby understood that the person or entity submitting the request is certifying that the proposed substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule.

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 19 – Waste Management and Disposal.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM E1971-05(2011), Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings.
- .2 Canadian Federal Legislation.
 - .1 Canadian Environmental Protection Act (CEPA).
 - .2 Canadian Environmental Assessment Act (CEAA).
 - .3 Transportation of Dangerous Goods Act (TDGA).
 - .4 Motor Vehicle Safety Act (MVSA).
- .3 Refer to C6 – Responsibilities of Contractor, in General Conditions for Construction.

1.3 QUALITY ASSURANCE

- .1 Ensure all work is performed in compliance with CEPA, CEAA, TDGA, MVSA, and all applicable federal and provincial regulations.
- .2 Except for items specifically noted, waste or abandoned materials and equipment are Contractor's property and must be promptly removed from site.
- .3 Equipment and re-useable items remain property of the City and must be stored as directed.

1.4 POLLUTION CONTROL

- .1 Maintain pollution control features installed under this contract.
- .2 Ensure proper disposal procedures as indicated herein are maintained throughout project.
- .3 Control emissions from equipment and plant to local authorities emission requirements.
- .4 Prevent sanding dust and other extraneous materials from contaminating air beyond application area by providing temporary enclosures.

1.5 FIRES

- .1 Fires and burning of rubbish on site not permitted

1.6 WASTE MANAGEMENT

- .1 Refer also to Section 01 74 19.
- .2 Provide on-site covered commercial waste containers for collection of non-hazardous waste materials and debris. Keep containers covered to minimize spread of dust or other contaminants. Deposit waste in containers as work progresses and at end of each working day.
- .3 Place materials defined as hazardous, volatile, or toxic waste in special metal containers designated for hazardous waste and dispose of at end of each working day.
- .4 Waste Management and Disposal.
 - .1 Separate and recycle packaging and waste materials to maximum extent economically possible.
 - .2 Collect and separate plastic, paper packaging, and corrugated cardboard in designated areas for recycling as work proceeds and at completion of the work.

- .3 Separate wood waste and place in designated areas in following categories for disposal or recycling: solid wood/softwood/hardwood, and treated, painted, or contaminated wood.
- .4 Set aside damaged wood and dimensional lumber off-cuts for approved alternative uses (e.g. blocking).
- .5 Collect, package and store partially used or unused containers of asphalt, sealing compound, primer and roofing felts for recycling.
- .6 Place materials defined as hazardous or toxic waste in designated containers.
- .7 Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this Section.
- .8 Close and seal tightly, all partly used sealant containers and store protected in well ventilated fire-safe area at moderate temperature.
- .9 Place used sealant tubes and other containers in areas designated for hazardous materials.
- .10 Unused paint, caulking, and sealing compound materials must be disposed of at an official hazardous material collections site in accordance with legislation and authorities having jurisdiction. Do not dispose into sewer system, onto ground or in other location where it will pose health or environmental hazard.
- .11 Ensure all emptied containers are sealed and stored safely for disposal.
- .12 Fold up metal banding, flatten, and place in designated area for recycling.
- .13 Plan and co-ordinate insulation work to minimize generation of waste.
- .14 Designate on-site location for containers which facilitate recyclable materials without hindering daily operations.

1.7 DISPOSAL OF NON-HAZARDOUS WASTE

- .1 Do not sell or bury rubbish on site.
- .2 Obtain approval and pay for use of off-site municipal collection or local dump or sanitary landfill sites, depending upon materials involved in accordance with authorities having jurisdiction.
- .3 Where recycling is available, collect waste by type and co-ordinate pickup or delivery to recycling or collection facility.

1.8 DISPOSAL OF HAZARDOUS WASTE

- .1 Obtain legislation governing disposal of hazardous and toxic materials, and pay for disposal of these materials in accordance with this legislation and authorities having jurisdiction and requirements of contract documents.
- .2 Do not dispose of water or volatile materials such as: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.

1.9 DRAINAGE

- .1 Do not pump water containing suspended material into waterways, sewer or drainage systems.
- .2 Control disposal of water containing suspended material or other harmful substances in accordance with local authority requirements.

Part 2 Products

Part 3 Execution

3.1 PROGRESSIVE CLEANING

- .1 Maintain cleanliness of work and surrounding site to comply with federal, provincial, and local fire and safety laws, ordinances, codes, and regulations.

- .2 Co-ordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials that will create hazardous conditions.
- .3 Vacuum clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations. Continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.
- .4 Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
- .5 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .6 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning manufacturer.

3.2 FINAL CLEANING

- .1 When work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining work. Conduct inspection of sight exposed interior and exterior surfaces.
- .2 Leave the work 'broom clean' before the inspection process commences.
- .3 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel or baked enamel. Replace broken, scratched or disfigured glass.
- .4 Clean lighting reflectors, lenses, and other lighting surfaces.
- .5 Remove stains, spots, marks, and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls and floors.
- .6 Vacuum clean and dust building interiors, behind grilles, louvers and screens.
- .7 Wax, seal, shampoo, or prepare floor finishes as recommended by the manufacturer.
- .8 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .9 Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.
- .10 Inspect finishes, fitments and equipment and ensure proper workmanship and operation.
- .11 Broom clean and wash exterior walks, steps and platforms.
- .12 Broom clean parking lots, pads and paving accessible to vehicle traffic.
- .13 Remove dirt and other disfigurations from exterior surfaces.
- .14 Clean and sweep roofs, gutters, areaways, sunken wells.
- .15 Sweep and wash clean paved areas. Rake clean other surfaces of grounds.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 31 00 – Project Management and Co-ordination.
- .2 Section 01 33 00 – Submittals Procedures.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Refer to D31 – Warranty, of Supplemental Conditions and C13 – Warranty, of General Conditions for Construction.
- .2 Pre-warranty Meeting:
 - .1 Convene meeting one (1) week prior to contract completion with Contractor's representative, the City and Consultant:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
 - .2 Consultant to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Submit one (1) electronic copy in Adobe PDF format, plus one (1) hard copy to Consultant for his review prior to submitting final copies. One (1) copy will be returned after final review, with Consultant's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Submit to Consultant, two (2) weeks prior to Substantial Performance of the Work, final revised copies of operating and maintenance manuals, in English, consisting of one (1) electronic copy in PDF format, plus three (3) hard copies.
- .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 AS-BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at the site for Consultant one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.

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

1.5 PROJECT RECORD DOCUMENTS

- .1 Maintain at construction site, three sets of white prints for record drawing purposes. Mark one set "FIELD DRAWINGS" and use to record initial data when field measurements are made. Mark other two sets "RECORD DRAWINGS".
- .2 Store record drawings in field office apart from other documents used for construction. Maintain record drawings in clean, dry and legible condition. Do not use record drawings for construction purposes.
- .3 Record "as-built" information in red ink, accurately and concurrently with construction progress. Do not conceal work until required information is recorded.
- .4 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 Addenda, Change Order and Field Instruction.
 - .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.
- .7 Provide digital photos, if requested, for site records.
- .8 At completion of project and prior to final review, neatly transfer "as-built" notations to second and third set of white prints and submit to Consultant along with field drawings. In addition, submit AutoCAD disks of project with all changes relined to reflect "as-built" conditions. Drawings must be generated in most current AutoCAD version, and consistent with Bid Documents prepared in AutoCAD 2019.
 - .1 For Contractors' use in preparation of "as-built" drawings required under this contract, Contractors may purchase from Consultant, electronic AutoCAD drawing files in accordance with Section 01 33 00.

1.6 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue all items.
 - .1 Submit inventory listing to Consultant.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue all items.
 - .1 Submit inventory listing to Consultant.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue all items.
 - .1 Submit inventory listing to Consultant.
 - .2 Include approved listings in Maintenance Manual.
- .4 Delivery, Storage, And Handling:
 - .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
 - .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
 - .3 Store components subject to damage from weather in weatherproof enclosures.
 - .4 Store paints and freezable materials in a heated and ventilated room.
 - .5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.7 OPERATION AND MAINTENANCE MANUALS

- .1 Prepare Operation and Maintenance Manuals for each Architectural, Mechanical and Electrical component of project.
- .2 Format.
 - .1 Organize data in form of an instructional manual.
 - .2 Binders: vinyl, hard covered, 3 “D” ring, loose leaf spine and fact pockets.
 - .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 printed title “Operation and Maintenance Manual”; list title of project and identify subject matter of contents.
 - .5 Arrange content 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.

- .3 Contents (each volume).
 - .1 Table of Contents: provide title of project; date of submission; names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; schedule of products and systems, indexed to content of volume.
 - .2 For each product of system; list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement arts.
 - .3 Product Data; Mark each sheet to clearly identify specific products and component parts and data applicable to installation; delete inapplicable information.
 - .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
 - .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.
- .4 Equipment and Systems.
 - .1 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
 - .2 Include installed colour coded wiring diagrams.
 - .3 Operating Procedures: Include complete list of equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number. Provide written explanation of operation of each system with instructions for trouble shooting of operational failures. 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.
 - .4 Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - .5 Provide servicing and lubrication schedule, and list of lubricants required.
 - .6 Include manufacturer's printed operation and maintenance instructions.
 - .7 Include sequence of operation by controls manufacturer.
 - .8 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - .9 Provide installed control diagrams by controls manufacturer.
 - .10 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
 - .11 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 - .12 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - .13 Include test and balancing reports as specified.
 - .14 Additional requirements: including one complete set of final reviewed and stamped shop drawings; cop of hardware and paint schedules; requirements specified in individual specification sections.
- .5 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 as applicable.
 - .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .4 Additional Requirements: As specified in individual specifications sections.

1.8 EQUIPMENT AND SYSTEMS

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

1.9 CONSTRUCTION PHOTOGRAPHS

- .1 Submit construction photographs as specified in Section 01 31 00.

1.10 WARRANTIES AND BONDS

- .1 Refer to D31 – Warranty, of Supplemental Conditions and C13 – Warranty, of General Conditions for Construction.
- .2 Develop warranty management plan to contain information relevant to Warranties.
- .3 Submit warranty management plan, 30 days before planned pre-warranty conference, to Consultant approval.
- .4 Warranty management plan to include required actions and documents to assure that Consultant receives warranties to which it is entitled.
- .5 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

- .6 Submit, warranty information made available during construction phase, to Consultant for approval prior to each monthly pay estimate.
- .7 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) Working Days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .8 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, lightning protection systems, .
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Contractor's plans for attendance at four (4) and nine (9) month post-construction warranty inspections.
 - .5 Procedure and status of tagging of equipment covered by extended warranties.
 - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions:
 - .1 Failure to respond will be cause for the Consultant to proceed with action against Contractor.
- .11 Warranty Tags
 - .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Consultant.
 - .2 Attach tags with copper wire and spray with waterproof silicone coating.

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

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 64 00 – City Furnished Products.
- .2 Section 01 78 00 – Closeout Submittals.

1.2 DESCRIPTION

- .1 Provide comprehensive demonstration and training program to the City's personnel on operation and maintenance of all Contractor supplied and installed equipment and systems. This program to commence two (2) weeks prior to date of Substantial Performance of the Work.
- .2 The City will provide list of personnel to receive demonstration and training, and will co-ordinate their attendance at agreed-upon times.
- .3 Schedule demonstration and training sessions by manufacturer's authorized representative, and provide manufacturer produced training manuals and CD's if available for demonstration purposes.
- .4 In event that manufacturer produced training CD's are not available, video record demonstration and training sessions digitally recorded on CD in following formats: Real Player, Windows Media Player, and Quicktime.

1.3 SUBMITTALS

- .1 Submit proposed schedule of time and date for demonstration and training of each item of equipment and each system prior to designated dates, for the City's approval.
- .2 Submit report within one week after completion of each demonstration and training session, that session has been satisfactorily completed. Identify time and date of each session, including list of the City's personnel present.

1.4 CONDITIONS FOR DEMONSTRATION AND TRAINING

- .1 Equipment and systems have been reviewed by Consultant.
- .2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals and test reports for use in demonstrations and instructions.

1.5 DEMONSTRATION AND TRAINING

- .1 Demonstration and training to include start-up, operation, control, adjustment, trouble-shooting, servicing and maintenance of each item of equipment at scheduled times, at equipment location.
- .2 Instruct the City's personnel in all aspects of operation and maintenance of equipment and systems referencing manufacturer's operation and maintenance manuals.
- .3 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.
- .4 Perform demonstration and training program provided under Contract to the City's satisfaction by quality persons knowledgeable in operation and maintenance of installed equipment and systems, and for duration acceptable to the City.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM E1971-19, Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings.
- .2 Canadian Federal Legislation.
 - .1 Canadian Environmental Protection Act (CEPA).
 - .2 Canadian Environmental Assessment Act (CEAA).
 - .3 Transportation of Dangerous Goods Act (TDGA).
 - .4 Motor Vehicle Safety Act (MVSA).
- .3 Canadian Standards Association (CSA).
 - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .4 National Building Code of Canada, 2010 (NBCC).
 - .1 NBCC Division B Part 8, Safety Measures at Construction and Demolition Sites.

1.2 QUALITY ASSURANCE

- .1 Ensure all work is performed in compliance with CEPA, CEAA, TDGA, MVSA, and all applicable provincial regulations.
- .2 Comply with Workplace Safety and Health Act, Workplace Safety Regulation, Manitoba with regards to health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of work.

1.3 SUBMITTALS

- .1 Submit written request in advance of cutting or alteration which affects the following:
 - .1 Structural integrity of any element of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
- .2 Include in request the following:
 - .1 Identification of Project.
 - .2 Location and description of affected work.
 - .3 Statement on necessity for cutting or alteration
 - .4 Description of proposed work, and products to be used.
 - .5 Date and time work will be executed.

1.4 SITE CONDITIONS

- .1 Existing Services.
 - .1 Do not, under any circumstances drill, cut or chase openings of any description in any part of existing building structure, without written approval from the City. The City will supervise any work of this type and will require x-ray inspection or Ground Penetrating Radar (GPR) of structure to be cut prior to drilling at Contractor's expense.
 - .2 No employee of the City is authorized to give approval of Contractor for any drilling unless results of x-ray inspection or Ground Penetrating Radar (GPR) are provided to the City prior to drilling and approval of the City is communicated to Contractor in writing.
 - .3 Before commencing work, establish location and extent of service lines in area of work. Be absolutely certain of their origin and destination.

- .4 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .5 Record locations of maintained, rerouted and abandoned service lines on project record documents in accordance with section 01 78 00.
- .2 Existing Hazardous Materials.
 - .1 Removal and handling of hazardous materials is to be performed only by persons trained in methods, procedures and industry practices for safe handling and removal of hazardous materials.
 - .2 Mould: immediately stop work should any unidentified or unforeseen mould contaminated materials be encountered during course of work and notify Consultant and the City upon discovery of material.

1.5 SCHEDULING

- .1 Co-ordinate demolition and removal of debris to ensure minimal disruption to existing building.
- .2 Execute work with least possible interference, inconvenience or disturbance to occupants, public and normal use of premises. Keep noise and dust to minimum.
- .3 Use only spark proof tools and equipment where explosive fumes may exist either from demolition work, renovation work, or existing operations.

Part 2 Products

Part 3 Execution

3.1 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during demolition. Photograph existing conditions in accordance with the City. Conduct a condition survey of building areas to remain before commencing demolition.
- .2 Utilize dustproof hoarding and temporary partitions in accordance with the City instructions to fully isolate the demolition work from existing building areas to remain to separate dust generating activities from occupied facility. Maintain until such work is complete. Contractor will be responsible for any and all demolition contamination to the City's occupied facilities adjacent to the demolition area.
- .3 Where security of existing building areas to remain has been reduced by work, provide temporary means to maintain security acceptable to Consultant and the City.
- .4 Provide and maintain temporary fire protection equipment during performance of work required by and governing codes, regulations and bylaws.
- .5 Protect building systems, services and equipment as follows:
 - .1 Do not disrupt active or energized utilities designated to remain undisturbed. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
 - .2 Provide temporary dust screens, covers, railings, supports and other protection as specified.
 - .3 Provide protection from elements for areas which may be exposed by uncovering work.

- .6 Prior to start of any demolition ensure contaminated or hazardous materials have been removed from site and dispose of at designated disposal facilities in safe manner and in accordance with TDGA.
- .7 Prior to providing openings in structural elements of work for penetrations of mechanical and electrical work, non-invasive ground penetrating scanning of the existing structure must be conducted to determine rebar and structural steel support locations, area for work penetration are to be mapped out.
 - .1 When penetrating concrete floor, test holes are to be taken to determine the depth of the existing concrete topping, and shall not interfere with the existing structure. Scanning work must be co-ordinated with the City to ensure facility operations are not interrupted.
- .8 Disconnect electrical and telephone service lines entering areas to be demolished. Co-ordinate and schedule disconnects with the City. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .9 Disconnect and cap mechanical services in accordance with locations and requirements of local authority having jurisdiction and as follows:
 - .1 Sewer and water lines to be removed and capped by qualified tradesmen to prevent leakage in accordance with locations and requirements of authority having jurisdiction.
 - .2 Do not disrupt active or energized utilities designated to remain undisturbed.

3.2 DEMOLITION

- .1 Demolish structures and parts of structures to permit construction of renovations indicated.
- .2 Provide openings in non-structural elements of work for penetrations of mechanical and electrical work.
- .3 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.
- .4 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval of the City.

3.3 REPAIR/RESTORATION

- .1 Where penetrations through existing walls or floors result from removal or relocation of existing equipment, repair to standard of construction of surrounding material.
- .2 Refinish wall, ceiling and floor surfaces to match adjacent finished unless otherwise indicated.
- .3 Fit work to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- .4 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where otherwise indicated.
- .5 Patch holes (abandoned and not required for future services) in existing walls, floor and roofs resulting from demolition and removal of mechanical pipes and or ducts and electrical services.

3.4 CLEANING AND WASTE MANAGEMENT

- .1 Cleaning and waste management in accordance with Sections 01 74 00.
- .2 Equipment and re-useable items remain property of the City and must be stored as directed.
- .3 Maintain progressive cleaning of work and surrounding areas during renovations. Comply with provincial and local fire and safety laws, ordinances, codes, and regulations.

- .4 Vacuum clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations. Continue vacuum cleaning on an as-needed basis until renovations are ready for occupancy.
- .5 When work is substantially performed, remove remaining waste materials, tools, equipment, machinery and surplus materials not required for performance of remaining work.
- .6 Provide final cleaning in accordance with ASTM E1971 and leave work clean and suitable for occupancy.

3.5 PROTECTION

- .1 Conduct demolition operations to prevent injury to people and damage to adjacent building areas.
 - .1 Ensure safe passage of people around demolition area.
 - .2 Provide temporary dust screens, barriers, warning signs in locations where renovation and alteration work is adjacent to occupied areas.
- .2 At end of each day's work, leave work in safe and stable condition so that no part is in danger of toppling or falling.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 23 10 – Excavation, trenching and Backfilling.
- .2 Section 33 46 13 – Foundation Drainage Piping.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM D1709-16ae1, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
 - .2 ASTM D2103-15, Standard Specification for Polyethylene Film and Sheeting.
 - .3 ASTM D4833/D4833M-07(2013)e1, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
 - .4 ASTM E84-18b, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .5 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
- .2 National Fire Protection Association (NFPA).
 - .1 NFPA 701: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films, 2019 Edition.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.
- .2 Store roll materials on end, on pallets in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.
- .3 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MATERIALS

- .1 Sheet Dampproofing Membrane: 14 mil thickness fire-retardant laminate with two layers of multi-axially oriented, linear low-density polyethylene in accordance with NFPA 701, ASTM D2103, and ASTM E84, water/vapour permeance in accordance with ASTM E96/E96M, impact resistance in accordance with ASTM D1709, puncture resistance in accordance with ASTM D4833/D4833M.
- .2 Sheet Dampproofing Tape: manufacturer's purpose made fire retardant pressure sensitive tape. Minimum roll width 100 mm.

Part 3 Execution

3.1 EXAMINATION

- .1 Confirm that crawlspace has been backfilled and properly graded prior to commencing work of this Section. Ensure surface beneath sheet damproofing is smooth level and compacted, with no sharp projections.

3.2 INSTALLATION

- .1 Install sheet damproofing on floor of crawlspace as indicated in accordance with manufacturer's printed instructions.
- .2 Lap edges minimum 150 mm and tape with manufacturer's purpose made tape.
- .3 Wrap perimeter of sheet damproofing membrane around continuous pressure treated wood nailing strip and secure to concrete grade beam as detailed.
- .4 Cut a slit around concrete piles and any other penetrations to place the initial layer of sheet damproofing. Then cut a piece of sheet damproofing minimum width of 610 mm with "fingers" cut half the width of the sheet. Wrap sheet damproofing around penetration and securely strap with steel banding and completely tape fingers to the bottom layer of sheet damproofing.
- .5 Seal punctures in damproofing membrane. Use patching material at least 150 mm larger than puncture and seal.

END OF SECTION

PART 1 Mechanical General Provisions

1.1 GENERAL REQUIREMENTS

- .1 Comply with the requirements set out for the General Contractor.

1.2 APPLICATION

- .1 This Section applies to all parts of Division 22 and Division 23.
- .2 Divisions 21, 22, 23, as well as 25 shall constitute the Mechanical Sections of work.

1.3 REFERENCE STANDARDS

- .1 Conform with the requirements of the plans and specification, the local authorities having jurisdiction, and the Local Building Codes. In the case of conflicting requirements, be governed by the most severe regulations.
- .2 Use latest edition of all referenced codes, standards, regulations, etc.

1.4 WASTE MANAGEMENT DISPOSAL

- .1 Minimize construction waste sent to the landfill; separate and recycle materials as outlined in the Architectural specifications and Waste Management Plan.
- .2 It is required that every effort be given to divert 100% of the following materials from the landfill.
 - .1 Cardboard
 - .2 Plastic Packaging
 - .3 Rubble
 - .4 Steel
 - .5 Wood (uncontaminated)

1.5 DEFINITIONS

- .1 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Contractor" is used in the Division 21, 22, or 23 Specifications, it means the firm having a contract with the "City of Winnipeg" to perform, supervise and coordinate all work.
- .2 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Sub-Contractor" is used in the Division 21, 22, or 23 Specifications, it means the firm having a contract with the "Contractor" to perform, supervise and coordinate all work of that particular Division. This Sub-contractor shall be wholly responsible to the "Contractor" for all work of that Division.
- .3 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Engineer" is used in the Division 21, 22, or 23 specifications, it shall refer to Tower Engineering Group Limited Partnership, Unit 1 – 1140 Waverley St, Winnipeg, Manitoba, R3T 0P4, Telephone: (204) 925-1150, Fax: (204) 925-1155.

- .4 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Provide" is used in relationship to equipment, piping etc., in this Division, it shall mean "Supply, Install and Connect".
- .5 Whenever "Drawings and Specifications" are referred to in these documents, it means "the Contract Drawings and Specifications" (including all addenda and post contract revisions) of all Disciplines (Architectural, Structural, Mechanical and Electrical).

1.6 TRADE DEFINITIONS

- .1 All work called for in the Contract Documents shall be considered to be within the scope of the Contract, and shall be the responsibility of the Contractor.
- .2 The arrangement of the Drawings and Specifications into Divisions, Sections, and Trades is purely arbitrary, with the sole intention of clarifying the scope and content of the work required to complete the project. The actual division of the work amongst the sub-contractors shall be the responsibility of the Contractor, and the actual division of the work between the sub-sub-contractors shall be the responsibility of the sub-contractors.
- .3 The Contractor, at their option and as per their contracts with the Sub-Contractors, may delegate responsibility to the Sub-contractors for the division of the work.
- .4 The Sub-contractors, at their option and as per their contracts with the sub-sub-contractors, may delegate responsibility to the sub-sub-contractors for the division of the work.
- .5 Sections of the Mechanical specifications, and specific but arbitrary responsibility divisions noted in the Mechanical Specifications, are not intended to delegate functions nor to delegate work to any specific trade, but may be useful to the Contractor or Sub-contractor when dividing the work amongst the Trades and Sub-trades.
- .6 In the event of a dispute regarding the responsibilities of the various trades and sub-trades, the Contractor and Sub-contractors may request information or a recommendation from the Engineers and/or Architect. However, the Contractor and Sub-contractor shall be responsible for determining the final division of work.

1.7 SCOPE OF WORK

- .1 In general terms the scope of work includes all mechanical renovation work required for the new Bill and Helen Norrie Library project. Interior spaces included in the facility shall be as shown on the mechanical & architectural drawings. This shall include, but is not necessarily limited to the following:
 - .1 Make provisions to redirect the existing weeping tile pits pumped discharges (x 2) from the north exterior wall into the new storm sewer as shown on the attached mechanical renovation drawings. Mechanical/Plumbing contractor(s) shall be responsible for all new plumbing work inside the building as well as tying into new storm sewer being extended from the municipal street service as

part of the Civil/Underground Site Services Contractor's scope of work.
Coordinate final connections on site with Civil/Underground Site Services Contractor.

- .2 Make provisions to supply & install one (1) new space humidity sensor located in the existing crawlspace as shown on the submitted mechanical renovation drawings. New humidity sensor shall be connected to existing Direct Digital Controls (DDC) systems for monitoring of humidity levels in crawlspace as noted in the mechanical specifications.
 - .3 Connection to existing site services for the building.
 - .4 Start-up and commissioning of all mechanical equipment and systems.
- .2 The Mechanical work shall include all labour, materials, equipment, and tools required to install, test and place into operation a complete and fully operational Mechanical System consisting of the various sub-systems as described in, but not necessarily limited to, the items in the following sections and equipment schedules:
- | | |
|----------|-----------------------------------|
| 21 05 01 | Mechanical General Provisions |
| 21 05 05 | Basic Materials and Methods |
| 22 05 05 | Plumbing |
| 22 06 01 | Approved Substitutes for Plumbing |
| 23 09 00 | DDC Systems (Controls) |

1.8 SEPARATE PRICES

- .1 For additional information regarding Separate Pricing, refer to the Architectural Specifications & the Specification set out for the General Contractor.

1.9 UNIT PRICES

- .1 For additional information regarding Unit Pricing, refer to the Architectural Specifications & the Specification set out for the General Contractor.

1.10 ALTERNATE PRICES

- .1 For additional information regarding Alternate Pricing, refer to the Architectural Specifications & the Specification set out for the General Contractor. Refer to specification Section 01 23 00 – Alternates.

1.11 ALLOWANCES

- .1 For additional information regarding Allowances, refer to the Architectural Specifications & the Specification set out for the General Contractor.

1.12 SITE EXAMINATION

- .1 Visit and inspect the site of the work to verify the location and elevation of existing items and services (such as services, equipment, piping, conduit, etc.) which may affect the Tender and work of this Division, before submission of tender and proceeding with the work.
- .2 Make allowance to relocate all existing items/services as required, or to provide alternate locations/routings of new items/services as required. Confirm alternate locations/routings with the City of Winnipeg/Architect/Engineer prior to submitting Tender Pricing.
- .3 Claims for extra payments resulting from conditions which could have reasonably been foreseen during a pre-tender site examination will not be considered.

1.13 CONTRACT DRAWINGS

- .1 The Drawings for the Mechanical work are performance drawings, diagrammatic and approximately to scale, intended to convey the scope of work and indicate the general arrangement and approximate location of apparatus, fixtures and pipe/duct runs. These Drawings do not intend to show Architectural and Structural details.
- .2 Do not scale the Drawings. Obtain information involving accurate dimensions from dimensions shown on the Architectural and Structural drawings, and by site measurement.
- .3 Even though some piping and/or ductwork is not completely shown or is shown schematically, and all details are not shown or specified, it is expected that the contractors be familiar enough with their fields of work to complete the project to the standards generally adhered to by the local industry, including good workmanship and common sense. The Engineer reserves the right to furnish any additional detail drawings, which, in the judgement of the Engineer, may be necessary to clarify the work, and such drawings shall form a part of this contract. The work for such Clarifications shall be at no cost to the City of Winnipeg.
- .4 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (pipes or ducts around beams, columns etc.), and to provide complete and adequate service clearance.
- .5 The exact location of the Mechanical components may be changed by the contractors to suit site conditions, provided the changes are reviewed with the Engineer, the changes are duly noted on the 'Record' drawings, and the changes do not affect the operation or code-compliance of the system(s). Any such changes shall be at no cost to the City of Winnipeg.

1.14 CHANGES TO THE SCOPE OF WORK

- .1 From time to time during construction, changes to the scope of work may be proposed by the City of Winnipeg. These Proposed Changes are to be priced by the contractors in a timely manner. Only after the City of Winnipeg has reviewed and accepted the pricing, will these Proposed Changes be added to the contract.

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- .2 Pricing for the Mechanical portions of these Proposed Changes shall be submitted by the Sub-contractor to the Contractor complete with price breakdowns as follows:
 - .1 Sub-sub-contractors' prices c/w labor, material and overhead prices broken out.
 - .2 Sub-contractor's price c/w labor, material and overhead prices broken out.
 - .3 Pricing shall be submitted on an item-by-item basis. Each Proposed Change may contain more than one item.
 - .4 The City of Winnipeg/Engineer reserve the right to request detailed parts and materials breakdown pricing.

1.15 PHASING

- .1 Refer to the Architectural Drawings and Specifications for exact requirements.
- .2 During all phases of the work, certain portions of the facility must be kept fully functional. Re-route existing services and/or provide temporary service connections as required to meet this objective.
- .3 Coordinate with the City of Winnipeg and other contractors as required for shut-down of services.
- .4 Provide start-up, testing, verification and certification of the Mechanical Systems at the Occupancy Stage of each construction phase.
- .5 The contractors shall be responsible for determining the exact requirements for Phasing.

1.16 LIABILITY

- .1 Maintain all necessary insurance coverage to save and indemnify the City of Winnipeg.
- .2 Protect and maintain the work until the project has been completed and turned over to the City of Winnipeg. Protect the building and contents from damage during the construction period. Repair all damages without additional cost to the City of Winnipeg.
- .3 Special care shall be taken to insure that any existing equipment, structures, components and property are not damaged during the construction period. Repair all damages without additional cost to the City of Winnipeg.

1.17 WORK SCHEDULE

- .1 Unless otherwise noted, the work shall be scheduled for normal hours. The contractors shall be aware that off-hour work may be necessary for certain locations or types of work, and shall include the extra costs in the tender price.

- .2 Where the work requires the contractors to be in occupied areas, or where building services may be disrupted, the contractors shall closely coordinate the hours and areas of work with the City of Winnipeg's and occupants.
- .3 It shall be the responsibility of the Contractor to schedule the work to meet the City of Winnipeg's completion date. The Contractor shall coordinate the sub-trades and adjust the workforce as required to meet the schedule.

1.18 SUPERVISION

- .1 Maintain at this job site qualified personnel and supporting staff with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.
- .2 Supervision personnel and their qualifications are subject to the approval of the Engineer.

1.19 ENGINEERING SITE REVIEWS

- .1 The Sub-Contractor's work will be reviewed periodically by the City of Winnipeg, the Engineer, or their representatives, for the purpose of determining the general quality of the work. Guidance will be offered to the contractors in regard to interpretation of plans and specifications, to assist them in carrying out the work. Inspections, and directives given to the contractors, do not relieve the Contractor, and their agents, servants and employees, of their responsibility to provide the work in all of its parts, in a safe and workmanlike manner, and in accordance with the plans and specifications, nor impose upon the City of Winnipeg, and/or Engineer or their representatives, any responsibility to supervise or oversee the erection or installation of any work.
- .2 The Engineer will issue inspection reports and deficiency lists from time to time. All deficiencies shall be cleared up to the satisfaction of the Engineer within a reasonably short time period.

1.20 PATENTS

- .1 Pay all royalties and license fees, and defend all suits or claims, for infringement of any patent rights, and save the City of Winnipeg and Engineer harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Contractor or anyone directly or indirectly employed by them, or by reason of the use of any part, machine, manufacture or composition of matter on the work, in violation or infringement on such letters patent or rights.

1.21 CONSTRUCTION DRAWINGS

- .1 Where requested, prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structures, and all inserts, equipment bases, sumps and pits, supports, etc.

1.22 MUNICIPAL AND UTILITY SERVICES

- .1 Coordinate, arrange, and pay for all municipal and utility relocations, terminations and connections as required and shown on the drawings, complete with all required metering.
- .2 Install all metering equipment in accordance with municipal or utility requirements.
- .3 Test all services and provide report(s) as required by the Authorities Having Jurisdiction.

1.23 CODES, PERMITS, FEES AND INSPECTIONS

- .1 Comply with the most stringent requirements of the latest editions of the applicable C.S.A. standards; the requirements of the Authorities Having Jurisdiction; Federal, Provincial and Municipal Codes; and the applicable standards of the Underwriters' Association. These codes and regulations constitute an integral part of these specifications.
- .2 In case of conflict, the codes take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.
- .3 Before starting any work, submit the required number of copies of Drawings and Specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Engineer immediately of such changes, for proper processing of these requirements. Prepare and furnish any additional drawings, details or information as may be required. Information such as heat loss calculations, and other data that may be required can be obtained from the Engineer. Should the authorities require the information on specific forms fill in these forms by transcribing the information provided by the Engineer.
- .4 Apply for, obtain, and pay for all required permits, licenses, inspections, examinations, and fees.
- .5 Arrange for the inspection of all the work by the Authorities Having Jurisdiction over the work. On completion of the work, present to the Engineer the final unconditional certificate of approval of the inspecting authorities. When the Authorities Having Jurisdiction do not normally issue certificates, provide a declaration confirming that the Authorities have inspected and accepted the work.

1.24 DESIGN NOISE LEVELS

- .1 The maximum design noise levels for this project shall be as per ASHRAE Standards.
- .2 All equipment, components and systems shall be selected and installed with the intent of not exceeding these noise levels.
- .3 Where the equipment, components and systems fail to meet the noise level criteria, modifications shall be made as required, at no additional cost to the City of Winnipeg.

1.25 REQUESTS FOR USE OF SUBSTITUTE EQUIPMENT

- .1 Manufacturers listed as acceptable “Substitutes” have been deemed by the Engineer as capable of producing equipment and/or material of comparable quality, performance and approximate dimensions, and can be used in the preparation of the tender.
- .2 Manufacturers that are not listed are to review the tender specifications and determine if their products qualify as “equal” to the specified product in all respects.
- .3 Manufacturers are to review all drawing and specifications and familiarize themselves with the project and the product’s intended use, performance, physical dimensions, access and service requirements, etc.
- .4 Submit for review no later than 5 working days before tender closing, three hard copies of the proposed product shop drawings. Catalogue cut sheets or sales brochures will not be accepted or reviewed. Digital copies of submitted shop drawings will be acceptable in lieu of hard copies.
- .5 Submit the proposed product’s shop drawing(s) along with a copy of the original product specification and indicate all areas of Compliance and Non-Compliance with respect to the proposed product. If non-compliance is indicated, state the variance and how it affects performance, physical dimensions, access and service requirements, installation, etc.
- .6 If Compliance/Non-Compliance information is not provided the submission will not be reviewed and the proposed products will not be allowed for use.
- .7 Products reviewed as being acceptable “substitutes” shall be listed by addendum. Products/Manufactures not listed, reviewed or as accepted may submit as “Alternates”.
- .8 Refer to Section 21 05 10 – Acceptable Equipment, Materials and Products for additional requirements.

1.26 SHOP DRAWINGS

- .1 Present a schedule of shop drawings within two (2) weeks after the award of the contract, indicating the shop drawing submission and equipment delivery dates.
- .2 Shop Drawings submitted by the Contractor shall contain:
 - .1 Project Information such as Name and Address;
 - .2 Contractor Information such as Name, Address, Phone Numbers;
 - .3 Supplier Information such as Name, Address, Phone Numbers;
 - .4 Equipment Identification using the same System Name and Identification Number as the Contract Documents;
 - .5 All Equipment Information required for the Engineer to assess the suitability such as:

- .1 Make, Model, Size
 - .1 including schedules where numerous similar items are provided
 - .2 Physical Data such as:
 - .1 Dimensions
 - .2 Materials
 - .3 Weights
 - .4 Installation Requirements
 - .5 Installation Clearances
 - .3 Performance Data such as:
 - .1 Volume
 - .2 Pressure
 - .3 Capacity
 - .4 Performance Curves (with specified performance clearly marked)
 - .4 Motor Data such as:
 - .1 Horse Power
 - .2 Voltage/Phases
 - .3 Efficiency
 - .5 Specialty Items such as:
 - .1 Bearings
 - .2 Filters
 - .3 Internal Controls including safety lockouts
 - .4 Safety Items such as relief valves and regulators
 - .5 Options
 - .6 Wiring and Control Diagrams
- .3 Equipment Information may contain standard manufacturer's brochures, catalogue sheets, schematics, diagrams performance charts, illustrations, etc., but must have:
- .1 Information which is not applicable crossed off;
 - .2 Available listed options which are being provided clearly marked.
- .4 Shop Drawing Review:
- .1 In addition to project identification, date, etc., the form of stamp used in shop drawing review shall contain the following format:
 - .1 Drawing:
 - .1 Reviewed
 - .2 Reviewed As Noted
 - .3 Revise and Re-Submit

.4 Not Reviewed

.2 This review by the Engineer is for the sole purpose of ascertaining conformance with the general design concept.

.3 Review does not imply Engineer approved the detail design inherent in the shop drawings, this responsibility remains the Sub-contractor submitting same, and such review shall not relieve the Sub-contractor of responsibility for errors or omissions in the shop drawings, or of their responsibility for meeting all the requirements of the contract documents. The contractors are responsible for confirming and correlating dimensions at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades, as well as compliance with codes and inspection authorities such as C.S.A.

.5 Bind one (1) complete set of final shop drawings in each Operating and Maintenance instruction manual.

.6 Refer to the Architectural General Specifications for additional information.

1.27 COORDINATION

.1 The Contractor shall be responsible for the complete coordination amongst all trades, including timing, completion, deliveries, interference of building components and sequencing of the trades.

.2 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure compatibility of the system components.

.3 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure access to control panels on mechanical equipment for the purpose of completing fire alarm panel connections.

.4 The Contractor shall coordinate all trades to ensure that access doors and panels are of the same manufacturer, and of a style appropriate for the intended use.

1.28 EXPEDITING

.1 Continuously check and expedite delivery of equipment and materials. If necessary, inspect at the source of manufacture.

.2 Continuously check and expedite the flow of necessary information to and from all parties involved.

.3 Immediately inform the General Contractor if information is required from them.

1.29 AS-BUILT DRAWINGS

- .1 Obtain two (2) sets of white prints. Accurately record deviations from the contract documents caused by job conditions and ordered changes to indicate the installed work. Have prints available for inspection at Site at all times, and present at each meeting.
- .2 At the completion of the work, submit these sets of "As-Built" Drawings to the Engineer for review. Make changes as requested by the Engineer and resubmit. This process will continue until the "As-Built" drawings are deemed complete by the Engineer.
- .3 Arrange and pay for two (2) copies of the final "As-Built" Drawings to be produced and labeled "As-Constructed".
- .4 Submit the "As-Built" and "As-constructed" drawings to the City of Winnipeg.
- .5 Refer to the Architectural General Specifications for additional information.
- .6 At project end, a complete set of as-built drawings should be furnished of the building's mechanical systems, and turned over to the City of Winnipeg by the contractor. Refer to Section 01 78 00 - Closeout Submittals for further information.

1.30 CUTTING AND PATCHING

- .1 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening. The opening size shall be the minimum required. Patching will be the responsibility of the trades normally engaged in working with the finishing materials required to restore the opening to the original or specified conditions.
- .2 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.
- .3 Cutting, patching, and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment, piping and/or ductwork, and/or installation of new equipment, piping and/or ductwork in existing buildings is to be included in the tender price.

1.31 TEMPORARY SERVICES

- .1 Do not use any of the permanent mechanical systems during construction unless specific written approval is obtained from the Engineer and City of Winnipeg.
- .2 The use of permanent facilities for temporary construction service shall not affect, in any way, the commencement date of the warranty period.
- .3 If the permanent mechanical systems are used during construction, the equipment and systems shall be cleaned and refurbished as required to bring them back to a new/unused condition.

1.32 CHANGING OF EQUIPMENT DRIVES

- .1 If required, as determined from the review of the preliminary balancing report, changes to the equipment drives shall be carried out as follows:
 - .1 The Balancing Contractor is responsible for calculating and obtaining the new drives.
- .2 The contract shall include one drive change for each Air Handling Unit and each Fan with adjustable pulley drive.

1.33 TEMPORARY AND TRIAL USAGE

- .1 Do not use permanent systems or equipment during construction period, without written permission from the Consultant & City of Winnipeg.
- .2 The City of Winnipeg has the privilege of trial usage of mechanical systems, or parts thereof, for the purpose of testing and learning operational procedures.
- .3 Assist in the trial usage over a length of time, as deemed reasonable by the Engineer, at no extra cost, without waiver of responsibility or warranty.
- .4 Trial usage of systems or equipment is not warranty acceptance by City of Winnipeg.
- .5 Provide and pay for all testing required on the system components where, in the opinion of the Engineer, Manufacturer's ratings or specified performance is not being achieved.
- .6 Thoroughly clean & overhaul equipment used during construction period. Replace worn or damaged parts so equipment is in perfect condition, to entire satisfaction of the Consultant and City of Winnipeg. Routinely inspect all air filters. Clean or replace filters depending on filter type during period in which ventilation units are being used for temporary heat and/or commissioning of system. Contractor is responsible to pay all expenses for air filter cleaning service. Filters to operate between pressure drops noted in filter manufacturer's catalogue.
- .7 Temporary use of equipment shall in no way relieve Contractor of providing twelve month guarantee on all equipment used. This guarantee period shall commence as of date of final acceptance of building by City of Winnipeg as interpreted by Consultant.

1.34 SAFETY DEVICE TESTING

- .1 Make complete inspections of all safety devices such as: back flow preventors, freeze protection devices; fire dampers, smoke dampers, fire stops, and the like to ensure:
 - .1 That safety devices are complete in accordance with the specifications and Manufacturer's recommendations.
 - .2 That the safety devices are connected and operating according to all local regulations, and appropriate access is provided.

- .2 On completion of the inspections, provide letters and/or certificates, confirming that inspections have been completed. Insert in each Operation and Maintenance (O & M) Manual.

1.35 CLEANING

- .1 General Clean-up:
 - .1 The worksite shall be maintained in a condition of general cleanliness and tidiness.
 - .2 Provide, erect, maintain and remove temporary protective barriers and shelters. Use drop sheets, temporary walls or other means necessary to limit the spread of construction dirt and debris. Barriers shall be used to minimize the spread of dust, smoke, fumes and noise to other portions of the building.
 - .3 For renovation work, and for phased work where part of the building is occupied, coordinate and cooperate with the occupants throughout the duration of the project to maintain the site in a usable condition.
 - .4 For renovation work, and for phased work where part of the building is occupied, clean the site to the satisfaction of the occupants at the end of each work day, so as to neither inconvenience the occupants nor hinder the use of the facility.
 - .5 For renovation work, at the end of the project, provide cleaning services to leave the site in as clean a condition as existed before the commencement of the work.
- .2 Mechanical Systems Clean-up:
 - .1 At the completion of the project, leave all systems in full operation, the exterior of all new and renovated systems clean, and the work areas cleaned to the satisfaction of the Engineer, City of Winnipeg and Occupants.
 - .2 Clean exposed surfaces of new and renovated mechanical equipment, ductwork, piping, etc.
 - .3 The level of cleaning shall be consistent with the intended use of the building and the mechanical systems.
 - .4 The City of Winnipeg reserves the right to inspect the Mechanical Systems to determine the effectiveness of the cleaning. Where cleaning is deemed to be unacceptable, the cleaning shall be re-done at no extra charge to the City of Winnipeg.
- .3 Special Cleaning:
 - .1 Polish plated work.

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- .2 Vacuum clean and remove debris from the inside of all new air handling systems, fans, ducts, coils, terminal units, etc.
 - .3 Vacuum clean and remove debris from the inside of existing air handling systems, fans, ducts, coils, terminal units, etc., as noted on the floor plans.
 - .4 For New Ductwork, provide High Velocity Vacuum Cleaning. Provide Duct Access Doors as required.
 - .1 High Velocity Vacuum Cleaning shall be:
 - .1 Portable
 - .2 Capable of a minimum of 4,000 cfm
 - .3 Equipped with HEPA filtration which is 99.97% efficient for particles no greater than 0.3 microns in size, when system exhausts into the Workplace or Occupied Area
 - .5 Duct Cleaning Specialist(s) shall provide a report which shall include:
 - .1 Name, Address and Phone Numbers of the Company.
 - .2 Name(s) of Individuals Performing the Work.
 - .3 Description of the Work Performed, including methods, equipment, and extent of ductwork.

1.36 INSTRUCTIONS TO CITY OF WINNIPEG

- .1 Prepare a List of the Systems, to be signed by the City of Winnipeg after instructions are received.
- .2 Instruct the Contract Administrator's in all aspects of the operation of the systems and equipment. Prepare a List of the Systems, to be signed by the City of Winnipeg.
- .3 Arrange and pay for the services of Manufacturers' representatives required for the instruction on specialized portions of the installation.

1.37 OPERATION AND MAINTENANCE MANUALS

- .1 Assemble and submit to the City of Winnipeg/Architect/Engineer:
 - .1 One (1) hard-covered 3-ring binder with index tabs containing a complete set of manufacturers' operating and maintenance instructions showing all major equipment, and apparatus requiring maintenance for approval.
 - .2 One (1) electronic copy containing a complete set of manufacturers' operating and maintenance instructions showing all major equipment, and apparatus requiring maintenance for approval.

- .2 Instructions shall be complete for installation, operation and maintenance and shall include pertinent information such as detailed drawings, maintenance schedules, and addresses. Instructions shall be reviewed with Contract Administrator to ensure a thorough understanding of the operation.
- .3 The O & M Manuals shall each contain, but not be limited to the following information:
 - .1 Table of Contents,
 - .2 A certificate or letter stating that all systems have been commissioned and are operating as specified,
 - .3 Contractor Warranty letter and/or Contractor Sign-off Sheets,
 - .4 All sub-contractor's and suppliers names and telephone numbers,
 - .5 A brief description of systems,
 - .6 Overall Equipment Maintenance schedule with weekly, monthly, yearly maintenance instructions,
 - .7 Equipment Start-up reports,
 - .8 A complete set of reviewed shop drawings,
 - .9 Brochures,
 - .10 Data sheets,
 - .11 Wiring diagrams,
 - .12 Air and water testing and balance reports,
 - .13 Controls 'As-Built' shop drawings,
 - .14 Commissioning information,
 - .15 Valve tag schedule, valve position.
 - .16 Warranty certificates.
- .4 Present all copies of the Operation and Maintenance Manuals to the Engineer for review. The Engineer will review the manuals and return them with comments. The Sub-contractor shall make all requested changes. This process shall continue until the Manuals are deemed complete by the Engineer. The Sub-contractor shall turn over the completed manuals to the City of Winnipeg.

1.38 SPECIAL TOOLS AND SPARE PARTS

- .1 Refer to Section 21 05 20 – Mechanical Spare Parts & Maintenance Materials for further information & requirements.

1.39 WARRANTIES

- .1 No certificate issued, payment made, or partial or entire use of the system(s) by the City of Winnipeg, shall be construed as acceptance of defective work or material.
- .2 Include copies of all warranty and guarantee certificates and declarations in the O & M Manuals, in the appropriate sections.
- .3 Provide a certificate or declaration indicating the warranty and conditions.
- .4 Warranty satisfactory operation of all work and equipment installed under this contract. Repair or replace at no charge to the City of Winnipeg, all items which fail or prove to be

defective within the Warranty period, provided that the failure is not due to improper usage by the City of Winnipeg. Make good all damages incurred as a result of the failure and of the repair of the system(s).

- .5 The warranty shall be for all parts and labour. Do not expect any participation from the City of Winnipeg's personnel in the correction of warranty related work.
- .6 For systems, equipment and components which are used continuously throughout the year, the standard warranty period shall be one calendar year from the date of Substantial Completion. For seasonal equipment, components and systems which are not normally used continuously throughout the year, the warranty period shall include at least one full season of satisfactory operation.
- .7 When equipment or systems are put into use subsequent to the acceptance of the building, or a portion of the building, the warranty period for seasonally used equipment and systems shall be deemed to commence from the date of satisfactory operation, not from the date of final acceptance by the City of Winnipeg.
- .8 The City of Winnipeg retains the right to demand, and to receive, an extension of the original construction warranty for any equipment, component or system which consistently fails to perform, or which requires repeated repair or adjustment.
- .9 Wherever manufacturer's warranties in excess of the Contractor's Warranty are provided, furnish the City of Winnipeg with copies of the Certificates, dated and acknowledged, and inserted in the O & M Manuals. The Contractors Warranty shall include a list of the Manufacturer's extended warranties
- .10 Warranty work shall be carried out within a reasonable time period following the reporting of the problem. Should the repair time for any failed component be unreasonably long, as determined by the City of Winnipeg, make alternate arrangements to have a temporary replacement component made available until such time that the original component is repaired and re-installed. There shall be no additional cost to the City of Winnipeg for any temporary replacement component or for any labour required to implement the work.

1.40 DOCUMENTATION AND SYSTEM(S) ACCEPTANCE

- .1 The Contractor shall prepare a suitable document, to be signed by the City of Winnipeg or their representative, confirming:
 - .1 The City of Winnipeg has received satisfactory instruction in the operation and maintenance of all equipment and systems.
 - .2 The Operation and Maintenance Manuals have been received and reviewed by the City of Winnipeg.
 - .3 The "Record" and "As-Constructed" Drawings have been received and reviewed by the City of Winnipeg.

- .4 Specified spare parts, components, keys, removable handles, tools and the like, have been received by the City of Winnipeg.

1.41 COMPLETION

- .1 The Contractor shall be aware that it is the Engineer's intention to withhold recommendations for payment of progress claims totalling more than 95% of the mechanical contract until the project is declared Substantially Complete.
- .2 The close-out procedure may entail a take-over and occupancy of the building in more than one stage, depending on the specified phasing and the City of Winnipeg's timetable.
- .3 **SUBSTANTIAL COMPLETION**
 - .1 The Project will be ready for a Substantial Completion inspection only when it is ready for the City of Winnipeg to occupy and utilize the building for its intended purpose.
 - .2 At Substantial Completion, the City of Winnipeg will realize that some deficiencies may still exist.
 - .3 In preparation for the inspection to determine Substantial Completion for all or a portion of the project, the Contractor shall ensure and declare in writing that:
 - .1 Except for seasonal deficiencies, the Start-up and Verification of the Commissioning Process has been completed, and all systems are fully functional.
 - .2 All systems and equipment have been cleaned.
 - .3 All systems and equipment have been identified and labelled.
 - .4 The preliminary Record drawings have been submitted for review.
 - .5 One (1) set of preliminary O & M Manuals have been submitted for review.
 - .6 One (1) copy of the preliminary Balancing Report has been submitted for review.
 - .7 Instructions to the Contract Administrator have been given.
 - .8 Maintenance Materials and Spare Parts have been provided.
 - .4 When the Contractor is satisfied that the entire Project is completed, and after making their own inspection, they shall apply, in writing, to the Consultant, for an inspection to determine if the project can be deemed Substantially Complete.

- .5 In the Letter of Request, a date shall be specified upon which the Project can be delivered and be Substantially Complete.
- .6 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.
- .7 Based on the inspection report, the City of Winnipeg will retain a sum of money, sufficient in their estimation to cover the cost of completing the deficiencies.

.4 TOTAL COMPLETION

- .1 When the Contractor has determined that the deficiencies noted during the Substantial Completion inspection have been completed or corrected, they shall apply, in writing, to the Consultant, for a final inspection to determine if the Project is deemed Totally Complete.
- .2 In the Letter of Request, a date shall be specified upon which the Project can be delivered Totally Complete.
- .3 In preparation for the inspection to determine Total Completion for all or a portion of the Project, the Contractor shall ensure and declare in writing that:
 - .1 All aspects of the Commissioning Process have been completed.
 - .2 The final Record and As-Constructed drawings have been submitted, reviewed and accepted.
 - .3 The final O & M Manuals have been submitted, reviewed and accepted.
 - .4 The final Balancing Reports have been submitted, reviewed and accepted.
 - .5 The deficiencies noted during the Substantial Completion inspection have been corrected or completed.
- .4 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.
- .5 Based on the inspection report, the City of Winnipeg will retain a sum of money, sufficient in their estimation to cover the cost of completing the deficiencies.
- .6 Final Payment will only be made after the Project has been determined to be Totally Complete, with all deficiencies satisfactorily corrected.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

- .1 Section 21 05 01, Mechanical General Provisions.
- .2 Sections 22 06 01, Approved Substitutes for Plumbing.
- .3 Section 22 05 05, Plumbing.
- .4 Comply with the requirements of the Architectural Specifications.

1.2 SUBMITTALS

- .1 Shop Drawing Submittals:
 - .1 Submit a list of all nameplates, tags and labels, including wording, size and construction.
 - .2 Submit shop drawings for access doors, air filters, valves, expansion joints, air vents, strainers, thermometers and gauges, flow measurement devices.
- .2 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into Operation and Maintenance Manuals.
 - .2 Provide Spare Parts
- .3 Sustainability Submittals
 - .1 Conform to all of the requirements of the Architectural Specifications, but take special note in relation to Environmentally Friendly Materials, Garbage and Recycling, and Start-up and Commissioning.

1.3 SPECIAL TOOLS AND SPARE PARTS

- .1 General
 - .1 Conform to the requirements of the Architectural Specifications.
 - .2 Prepare a Suitable List/Sign-off Sheet to indicate the Materials provided.
 - .1 List shall Include all Materials.

- .2 List shall include spaces for Sign-off Names and Dates for the Contract Administrator.
 - .3 Identify spare parts containers as to contents and replacement parts number.
 - .4 Furnish a list of individual manufacturer's recommended spare parts for equipment such as belts, bearings and seals, including addresses of suppliers.
 - .5 Furnish a complete list and complete set of specialized tools necessary for adjusting, repairing or replacing the equipment
- .2 Provide one set of all specialized tools required to service equipment as recommended by the Manufacturers.
 - .3 Furnish one grease gun, and specialized adapters to suit different types of grease and grease fittings.

1.4 STANDARD OF EQUIPMENT, MATERIALS AND COMPONENTS

- .1 All equipment, materials and components shall be new and of first class quality.
- .2 All equipment, materials and components shall be of proven design, and of current models with published ratings, for which replacement parts are available.
- .3 Only use materials allowed by codes and the Authorities Having Jurisdiction.
 - .1 All equipment, materials and components shall be tested, certified and labeled by ULC and/or CSA for use in Canada. The certification and labeling shall be appropriate for the intended function of the item being supplied, as dictated by the relevant codes and standards.
 - .2 Where items are not adequately certified and labeled by the manufacturer, the contractor supplying the item shall be responsible for obtaining approval for the use of the item from the local Authority Having Jurisdiction, and shall bear all associated costs.
- .4 Where a manufacturer's name, make or model is specified, it is for the sole purpose of setting a standard of quality, performance, capacity, appearance, size and/or serviceability. Refer to Specification Schedule for approved 'Substitutes' and 'Alternates'.
- .5 Use only Copper, Bronze, Brass and Stainless Steel (no iron) for materials coming in contact with Domestic Water Systems.

1.5 IDENTIFICATION

- .1 All equipment, including motors shall come with proper nameplates affixed thereto, showing the manufacturer, make, model, size, serial number, horsepower, voltage, cycles, and all other pertinent data usually provided.
- .2 Identify all equipment, panels and controls with lamacoid nameplates indicating Identification Name and Number.
- .3 Identify all piping with direction-of-flow-arrows and service.
- .4 Identify all valves with metal (aluminum or brass) or lamacoid numbered tags with stamped code lettering and numbers filled with black paint and secured to items. Use for valves and operating controllers of all systems.
- .5 Identify all new ductwork with direction-of-flow-arrows and service.
- .6 Provide Special Signage as Specified or Noted on the Drawings.

1.6 CONSTRUCTION TECHNIQUES AND METHODS OF INSTALLATION

- .1 Only use techniques and methods allowed by codes and the Authorities Having Jurisdiction.
- .2 The selected techniques, methods of fabrication and installation, and the size of the labor force shall be suitable to meet the completion schedule.
- .3 The contractors shall be responsible for determining the most appropriate construction techniques and methods of installation for their portions of the work.
- .4 The contractors shall be responsible for laying out the systems, equipment, and components for their portions of the work.
- .5 The contractors shall consult with the manufacturers to obtain their installation recommendations, and shall comply with such recommendations and/or with local code requirements, whichever is the most stringent.
- .6 Patents
 - .1 Pay all royalties and license fees, and defend all suits or claims, for infringement of any patent rights, and save the City of Winnipeg and Engineer harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Contractor or anyone directly or indirectly employed by him, or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement on such letters patent or rights.
- .7 Construction Drawings

- .1 Where requested, prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structures, and all inserts, equipment bases, sumps and pits, supports, etc.

1.7 FIRE STOPPING

- .1 Conform to the requirements of the Architectural Specifications.
 - .1 Fire Stopping shall be carried out by a specific Sub-contractor to the General Contractor. Refer to the Architectural specifications.
 - .2 Fire Stop Materials shall be provided at all penetrations through fire and smoke separations. Refer to the Architectural Drawings for the locations of all separations.
 - .3 Fire Stop Materials shall be as approved by the Authorities Having Jurisdiction.
 - .4 Fire Stop Material installation shall be as per Manufacturer's recommendations.

1.8 PIPE HANGERS AND SUPPORTS

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 All materials listed below that are used in the building interior, (i.e. inside of the exterior air barrier) must not exceed the following requirements:

- .1 Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management District (SCAQMD) Rule #1168 requirements in effect on January 1, 2003 and rule amendment dated October 2, 2003.
- .2 Aerosol Adhesives: Green Seal Standard GS-36 requirements in effect on October 19, 2000.
- .2 Adhesives must contain no urea-formaldehyde.

PART 2 Products And Materials

2.1 IDENTIFICATION

- .1 Match existing Identification System(s), or provide as detailed herein.
- .2 Language: English
- .3 Equipment, Panels and Controls:
 - .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
 - .2 Construction:
 - .1 3 mm (1/8") thick lamacoid plastic, with square corners and beveled edges, letters accurately aligned and machine engraved into core.
 - .1 Alternate of white matte finish anodized aluminum will be allowed
 - .3 Sizes:
 - .1 Conform to the following table

Size #	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8

Size #	Sizes (mm)	No. of Lines	Height of Letters (mm)
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .4 Use maximum of 25 letters/numbers per line.
- .5 Identify the name of the equipment or equipment service and it's number, ie: 'Fume Hood Exhaust Fan EF-27'.
 - .1 The wording shall be the same as the Drawings and Specifications. Prior to ordering, the wording of all equipment tags shall be submitted to the Engineer for review.
- .4 Locations:
 - .1 Terminal cabinets, control panels: use size # 5.
 - .2 Equipment in Mechanical Rooms: use size # 9.
 - .3 Equipment in Mechanical Room:
 - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
 - .2 Main identifier: size #9.
 - .3 Source and Destination identifiers: size #6.
 - .4 Terminal cabinets, control panels: size #5.
 - .4 Equipment elsewhere: sizes as appropriate.
- .5 Valves:
 - .1 35 mm (1-3/8") diameter Laminated Plastic or Brass tags with 12 mm high identification data.
 - .1 Brass tags shall have the imprinted data filled with black paint.
 - .2 Brass Tags shall be secured by brass chains.
 - .3 Laminated Plastic Tags shall be secured by thick plastic straps.
 - .4 Tags shall be secured to the valves.

- .2 Include a flow diagram for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

.6 Piping:

.1 Systems Governed By Codes:

- .1 Natural gas: to CSA/CGA B149.1 and authority having jurisdiction.
- .2 Sprinklers: to NFPA 13.

- .2 Piping identification shall be pre-manufactured labels, suitably attached for permanence, or stencils with painted lettering. Painted stencils shall be of a suitable color to contrast with the pipe/insulation color.

- .3 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.4 Pictograms:

- .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations

.5 Legend:

- .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.6 Arrows showing direction of flow:

- .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
- .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
- .3 Use double-headed arrows where flow is reversible.

.7 Extent of background colour marking:

- .1 To full circumference of pipe or insulation.
- .2 Length to accommodate pictogram, full length of legend and arrows.

.8 Materials for background colour marking, legend, arrows:

- .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
- .2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.9 Colours and Legends:

- .1 Where not listed, obtain direction from Engineer
- .2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	Black
Green	White
Red	White

.10 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Heating water supply	Yellow	HWS
Heating water return	Yellow	HWR
Domestic hot water supply	Green	DHW
DHW recirculation	Green	DHWR
Domestic cold water supply	Green	DCW
Sanitary	Green	SAN
Plumbing vent	Green	SAN VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Natural gas	to Codes	
Gas regulator vents	to Codes	
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

.7 Ductwork:

- .1 Ductwork identification shall be painted stencils of a suitable color to contrast with the duct/insulation color.
- .2 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .3 Colours: black, or co-ordinated with base colour to ensure strong contrast.

- .8 Special Signage:
 - .1 Supply a total quantity of thirty (30) signs for installation by the City of Winnipeg.
 - .2 Each shall be 3mm (1/8") thick lamacoid plastic name plates, 4" (high) x 6" (wide), with bevelled edges, having 1/2" high engraved white letters on a black background.
 - .3 Each shall be bi-lingual, indicating 'NON-POTABLE WATER'. Exact wording to be provided by City of Winnipeg prior to Ordering.

2.2 HANGERS AND SUPPORTS

- .1 General
 - .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
 - .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.
- .2 Pipe Hangers
 - .1 General:
 - .1 Provide adjustable Clevis type equal to Grinnell Fig. 65 for pipe sizes up to and including N.P.S. 2.5. For pipe sizes N.P.S. 3 and over, provide adjustable Clevis type equal to Grinnell Fig. 260. Use rod sizes as recommended by the manufacturer.
 - .2 On copper piping, provide copper plated type hanger or separate piping from hanger with an approved insulating tape or plastic coating.
 - .3 Provide oversized hangers to pass over insulation on all insulated water piping. Use insulation saddles to protect insulation.
 - .2 Finishes:
 - .1 Pipe hangers and supports: galvanized or painted with zinc-rich paint after manufacture.
 - .2 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
 - .3 Upper attachment structural: suspension from lower flange of I-Beam:

- .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: minimum 13 mm.
- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers.
- .4 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut.
- .5 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP69.
- .6 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies.
 - .2 Steel brackets.
 - .3 Sway braces for seismic restraint systems.
- .7 Hanger rods: threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .8 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel.
 - .2 Attachments for copper piping: copper plated black steel.

- .3 Use insulation shields for hot pipework.
- .4 Oversize pipe hangers and supports.
- .9 Adjustable clevis: material to MSS SP69, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
 - .2 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
 - .3 Finishes for steel pipework: black or galvanized.
 - .4 Finishes for copper, glass, brass or aluminum pipework: black or galvanized, with formed portion plastic or epoxy coated.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.
- .3 Riser Clamps
 - .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42
 - .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
 - .3 Bolts: to ASTM A307.
 - .4 Nuts: to ASTM A563.
- .4 Insulation Protection Shields
 - .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
 - .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.
- .5 Constant Support Spring Hangers

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
 - .2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
 - .3 Provide upper and lower factory set travel stops.
 - .4 Provide load adjustment scale for field adjustments.
 - .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
 - .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.
- .6 Variable Support Spring Hangers
- .1 Vertical movement (13 mm minimum, 50 mm maximum): use single spring pre-compressed variable spring hangers.
 - .2 Vertical movement (greater than 50 mm): use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
 - .3 Variable spring hanger complete with factory calibrated travel stops.
 - .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.
- .7 Equipment Supports
- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Alternate construction using manufactured items from a supplier such as 'Uni-strut' will be acceptable.
 - .2 Submit shop drawings c/w calculations.
- .8 Equipment Anchor Bolts And Templates
- .1 Provide templates to ensure accurate location of anchor bolts.
- .9 House-Keeping Pads
- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 150 mm larger than equipment; chamfer pad edges.

- .10 Provide concrete thrust blocks at each change of direction for underground water piping, as per drawing details.

2.3 PUMPS – GENERAL

- .1 Piping adjacent to pump to be supported from structure so no weight is carried on pump casings. Use long sweep elbows at pump.
- .2 Provide coupling guards on all pumps.
- .3 Submit certified pump curves with shop drawings. Pump impeller not to exceed size suitable for operating at 85% of maximum pumphead at specified flow rate, unless given specific written acceptance of deviation by Consultant.
- .4 Mount on cast iron or heavy steel base, having drip lips and tapped drainage holes. Provide air cock on each pump.
- .5 Pump bases to have type NSN vibration isolators of sizes recommended by manufacturer. Refer to standard details for installation and forming of pump bases.
- .6 Manufacturer to include for checking and aligning pumps prior to start-up.
- .7 Casing section below packing glands is to have a tapped drainage hole to allow packing gland leakage to be piped to drain.
- .8 For all pump installations, present a written "Pump Performance Report", prior to substantial completion. This report will verify that pump meets design performance criteria; pressure, gpm, amp draw and correct impeller size.

2.4 SCREWS, BOLTS AND FASTENERS

- .1 Use standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hex heads, zinc plated 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, etc. shall be heavy-duty.
- .4 Bolts shall not project more than one (1) diameter beyond nuts (this includes threaded rod on hanger supports).
- .5 For flanged connections on all other services, bolts shall be grade 5, nuts shall be grade 8.
- .6 Apply liberal amount of never seize compound to all bolts used on exterior applications and all flanged connections within building (all services).

.7 Washers:

- .1 Use zinc plated washers on equipment, sheet metal and soft gaskets lock type washers where vibration occurs, and resilient type washers with stainless steel.

2.5 INSERTS

- .1 Use factory-made threaded or toggle type inserts as required for supports and anchors, properly sized for the load to be carried.
- .2 Use factory made expansion shields where inserts cannot be placed, but only as approved by the Engineer in writing and for light weights.
- .3 Do not use explosive powder activated tools except with the written permission of the Engineer.

2.6 SLEEVES

- .1 Provide the following for pipe sleeves:
 - .1 Through interior walls, exterior walls above grade, interior non waterproof floors: Machine cut schedule 40 steel pipe, medium cast iron or 18 gauge galvanized steel or plastic.
 - .2 Through walls below grade, waterproof floors, floors in janitor's closets, equipment rooms, and kitchens: machine cut medium cast iron, D.W.V. copper or copper sheet extended 100 mm (4") above the floor and cut flush with the underside.
 - .3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
 - .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .2 Provide the following for ductwork:
 - .1 Where fire dampers are not required in poured walls:

removable wood box of required size.
 - .2 Where fire dampers are not required in block or brick walls:

masonry to be built around ducting.

- .3 Where fire dampers are required:
 - 18 gauge galvanized steel or heavier sleeves complete with steel angle framing both sides installed in accordance with requirements of Authorities.
- .4 Through Equipment Room floors:
 - provide 100 mm (4") high curbs and install as described above.

2.7 ESCUTCHEONS

- .1 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.
- .2 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

2.8 PIPE AND FITTINGS

- .1 Any piping located in vertical service spaces (i.e. vertical shafts c/w fire ratings) shall be installed with non-combustible piping material as per the Manitoba Building Code requirements.
- .2 Condensate drip drains:
 - .1 Drainage grade copper tubing with soldered copper drainage fittings.
- .3 Sanitary Drainage and Vent - internal and within 1.52m (5'-0") of building line:
 - .1 Buried:
 - .1 Where approved by the Authorities Having Jurisdiction:
 - .1 PVC with solvent welded fittings.
 - .2 Suspended:
 - .1 DWV copper with soldered copper or cast bronze drainage fittings,
 - .2 Where approved by the Authorities Having Jurisdiction:
 - .1 PVC with solvent welded fittings.
- .3 Vertical Risers in shafts below the top floor:

- .1 Medium weight cast iron soil pipe with M.J. fittings with corrugated CSA approved M.J. clamp,
or
- .2 DWV copper with soldered copper or cast bronze drainage fittings,
- .4 Storm Drainage - internal and within 1.52m (5'-0") of building line:
 - .1 Buried:
 - .1 Where approved by the Authorities Having Jurisdiction:
 - .1 PVC with sovent welded fittings.
 - .2 Suspended:
 - .1 Where approved by the Authorities Having Jurisdiction:
 - .1 PVC with solvent welded fittings.
 - .3 Vertical Risers in shafts below the top floor:
 - .1 Medium weight cast iron soil pipe with M.J. fittings with corrugated CSA approved M.J. clamp,
 - .5 Sanitary Drainage - external beyond 1.52m (5'-0") of building line:
 - .1 PVC pressure sewer pipe.
 - .6 Sewage and Sump Pump discharge pipe:
 - .1 PVC pressure sewer pipe.
 - .2 DWV copper with soldered copper or cast bronze drainage fittings,

2.9 VALVES

- .1 General
 - .1 It is generally preferable that ball valves and butterfly valves be used in place of gate valves providing they meet the pressure, temperature, and fluid handling requirements of the system.
- .2 Gate Valves

- .1 Valves DN 50 (NPS 2) and smaller for threaded ends: Jenkins #810, Crane #428, Toyo 293, Lunkenheimer #2125, Kitz 24, Nibco T111, Milwaukee #148, Newman Hattersley T607M.
 - .2 Valves DN 50 (NPS 2) and smaller for soldered ends: Jenkins #813, Crane #1324, Toyo 299, Lunkenheimer #2131, Kitz 43, Nibco 5134, Milwaukee #149, Newman Hattersley T609M.
 - .3 Valves DN 65 (NPS 2.5) and larger: iron body non-rising stem, Jenkins #452, Crane #461, Toyo #415A Lunkenheimer #1428, Kitz 75, Nibco F619, Milwaukee F2882-M, Newman Hattersley T501.
 - .4 Lockshield valves DN 50 (NPS 2) and smaller: Crane 428 Lockshield, Toyo 293, Lunkenheimer #2127, Kitz 24, Nibco T111LS.
- .3 Ball Valves:
- .1 Valves DN 50 (NPS 2) and smaller for threaded ends: Bronze construction with TEF packing and seat, raised lever handle, Jenkins 33, Crane 9302, Toyo 5044A Lunkenheimer 747 F, Kitz 56, Nibco T580, Milwaukee BA100, Newman Hattersley 1969.
 - .2 Valves DN 50 (NPS 2) and smaller for soldered ends: Crane 9322, Toyo 5049, Kitz 57, Nibco S580, Milwaukee BA150, Newman Hattersley 1979.
- .4 Check Valves:
- .1 Spring checks at pumps DN 50 (NPS 2) and larger: Moyer and Groves Ltd. I512WM5S, Checkrite 12CBTU, APCO 300 & 600, Nibco W960; Crane Uni-chek
 - .2 Miscellaneous locations:
 - .1 Valves DN 50 (NPS 2) and smaller: Jenkins #4092, Crane #37, Toyo #236, Lunkenheimer #2144, Kitz 22, Nibco T433B, Milwaukee 509, Newman Hattersley 47.
 - .2 Valves DN 65 (NPS 2.5) and larger: Iron body flanged, Jenkins #587, Crane #373, Toyo #435A, Kitz 78, Lunkenheimer #1390; Victaulic 2.5" to 3" style 716, 4" to 8" style 715 and 8" to 12" style 711, Nibco F918B, Milwaukee F2474-M, Newman Hattersley 651.
- .5 Drain Down Valves:
- .1 DN 20 to 50 (NPS 3/4 to 2): Brass construction ball action valve complete with cap and chain rated 150 psi steam 600 w.o.g. Toyo 5046, Milwaukee BA100H.

.6 Balancing Cocks:

- .1 Where gate valves are used for terminal isolation provide DeZurik series 425.

.7 Butterfly Valves:

- .1 Cast iron body, bronze or stainless steel discs, Buna N "O" rings, bronze bushings straight through or pinned shafts and stainless steel stem.
- .2 EPDM rubber resilient seat with temperature range of -40° to 120°C.
- .3 Tight shut-off to 1100 kPa (150 PSI) and 120°C (250°F).
- .4 Lug type body tapped for 1100 kPa (150 psi) A.N.S.I. drilling may be used in lieu of spool pieces for equipment removal.
- .5 Handles and operators: 50mm to 150mm (2" to 6"), use lever with multi-position adjustment. For DN 200 (NPS 8) and over use wheel operated, worm gear actuator.
- .6 Acceptable Standard: Keystone F1000/F1020; Crane Quartermaster 44BXB; Jenkins 2232E; Victaulic "Vic 300"; Nibco LD2000-3; Milwaukee M; Newman Hattersley 45-31552; Toyo 918-BES-L; Centerline L200L

2.10 EXPANSION FITTINGS AND LOOPS

- .1 Provide manufactured units, or provide pipe loops.
 - .1 Contractors shall be responsible for determining the appropriate method(s) to allow for pipe expansion and contraction of their piping.
 - .2 Contractors shall be responsible for sizing their expansion fittings and loops.
- .2 Slip Type Expansion Joints:
 - .1 Application: for axial pipe movement, as indicated.
 - .2 Repacking: under full line pressure.
 - .3 Body and packing housings: Class 150, 1MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness and flanges to match pipe.
 - .4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B.
 - .5 Anchor base: construction steel, welded to body.

- .6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.
- .7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.
- .8 Packing rings: six (6) minimum, PTFE or graphite impregnated non-asbestos.
- .9 Thermal plastic packing: PTFE or graphite impregnated non-asbestos slug supplied loose.
- .10 Lubricating fittings: pet cocks with grease nipple.
- .11 Plunger body and plunger:
 - .1 Plunger body: heavy wall carbon steel welded to body.
 - .2 Plunger: carbon steel with hex head for use with socket wrench.
- .12 Lubricant: to manufacturer's recommendations.
- .13 Lubricant gun: complete with hose assembly.
- .14 Drip connection: 20 MPa forged steel to ASTM A105/A105M. Include half coupling with drain plug
- .3 Bellows Type Expansion Joints:
 - .1 For axial, lateral or angular movements, as indicated.
 - .2 Type A: free flexing, factory tested to 1 1/2 times maximum working pressure. Furnish test certificates.
 - .3 Type B: externally pressurized, factory tested to 1 1/2 times maximum working pressure. Furnish test certificates.
 - .4 Bellows:
 - .1 Multiple bellows, hydraulically formed, for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.
 - .5 Reinforcing or control rings:
 - .1 2 piece nickel iron.
 - .6 Ends:

- .1 Flanges to match pipe.
- .7 Liner:
 - .1 Austenitic stainless steel in direction of flow.
- .8 Shroud:
 - .1 Carbon steel, painted.
- .4 Flexible Connection:
 - .1 Application: to suit motion as required.
 - .2 Minimum length in accordance with manufacturer's recommendations to suit offset.
 - .3 Inner hose: bronze or stainless steel, corrugated.
 - .4 Braided wire mesh bronze or stainless steel outer jacket.
 - .5 Diameter and type of end connection: as required
 - .6 Operating conditions:
 - .1 To match system requirements.
- .5 Anchors And Guides:
 - .1 Anchors:
 - .1 Provide as indicated, and as required.
 - .2 Alignment guides:
 - .1 Provide as indicated by conduit manufacturer.
 - .2 To accommodate specified thickness of insulation.
 - .3 Vapour barriers, jackets to remain uninterrupted.

2.11 CONNECTIONS BETWEEN COPPER & STEEL (PIPING); USE OF DIELECTRIC CONNECTIONS/ UNIONS

- .1 All connections between copper and carbon steel shall be joined with brass union(s) & brass nipple(s) minimum 152mm (6”) long. Dielectric unions are not acceptable.
 - .1 General: Compatible with system, to suit pressure rating of system.
 - .2 DN 50 (NPS 2) and under: isolating unions or bronze valves.
 - .3 Over DN 50 (NPS 2): Isolating flanges.

2.12 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 by 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 100mm (4”) concrete pad that extends a minimum of 150mm (6”) from edge of equipment.
- .3 Mount equipment suspended above floor level but not detailed, on platform bracketted from wall. Where wall thickness is inadequate to permit such brackets, carry supports to either ceiling or floor, or both as required.

2.13 WIRING AND ELECTRIC MOTORS

- .1 General:
 - .1 Permanently wired polyphase motors must comply with the relevant appliance or equipment efficiency act, or CAN/CSA-C390 clause 4.10.
 - .2 Electrically operated equipment shall bear a C.S.A. approval label.
- .2 Wiring:
 - .1 Electric power wiring (110V and greater) for equipment provided by mechanical trades is specified in Division 26.
 - .2 Electric control wiring (regardless of voltage) for equipment provided by mechanical trades is specified in Section 25 10 10 – Controls/Instrumentation – General Requirements.
 - .3 Power and Control wiring (regardless of voltage) of all control panels and devices (temperature, pressure, level, flow, etc.) required for the operation or control of mechanical equipment provided under this division, shall be installed

under the scope of work of Section 25 10 10 – Controls/Instrumentation – General Requirements, to the standards established under Division 26 and in accordance with code requirements.

- .1 This is with the exception of line voltage control devices which are wired in-line in the power circuit for 120V or 208V single phase cycling such as force flow thermostats, level controls and the like which shall be wired under Division 26 scope of work.
- .2 Refer to Section 25 10 10 – Controls/Instrumentation – General Requirements for additional information.
- .3 Motors:
 - .1 All motors shall be high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.
 - .2 Motors controlled by Variable Frequency Drives and intended for inverter duty, shall comply with NEMA MG-1, Part 31.
 - .3 Motors controlled by Variable Frequency Drives and intended for inverter duty, shall have integral overload/overheat protection.
 - .4 Generally, all motors 375 watt (1/2 H.P.) and smaller to be 120 volt, single phase, 60 cycle, unless otherwise specified or indicated.
 - .1 Single phase motors to be permanent split capacitor type.
 - .5 Generally, all motors larger than 375 watt (1/2 H.P.) to be 575 volt, three (3) phase, 60 cycle, unless otherwise specified or indicated.
 - .1 EEMAC Class B, squirrel cage induction
 - .2 Shall be Cema Design Normal torque, low starting current with Class B insulation for operation in maximum ambient of 40°C (105°F).
 - .3 Bearings to be rated for minimum B-10 life of 20,000 hours with a V-belt drive.
 - .6 General:
 - .1 Motors shall meet NEMA standard for maximum sound level ratings under full load
 - .2 Speed as indicated, continuous duty, built-in overload protection, resilient mount,

- .3 1.15 service factor.
- .4 Motors shall be drip proof unless otherwise specified.
- .7 Motors shall meet or exceed the following efficiency and power factor criteria for 1800 RPM motors.

EFFICIENCY TIMES POWER FACTOR (Note: F.L. means Full Load)

<u>H.P. (Kw)</u>	<u>F.L.</u>	<u>0.75 F.L.</u>	<u>0.50 F.L.</u>
1.0 (0.75)	0.57	0.49	0.36
1.5 (1.12)	0.61	0.54	0.41
2.0 (1.50)	0.65	0.58	0.45
3.0 (2.25)	0.60	0.55	0.43
5.0 (3.75)	0.69	0.64	0.53
7.5 (5.62)	0.64	0.58	0.47
10 (7.50)	0.69	0.65	0.54
15 (11.25)	0.71	0.69	0.61
20 (15.00)	0.73	0.70	0.61
25 (18.75)	0.72	0.68	0.62
50 (37.50)	0.79	0.77	0.70

- .4 Temporary Motors
 - .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Consultant for temporary use. Work will only be accepted when specified motor is installed.
- .5 Belt Drives
 - .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
 - .2 Fit reinforced belts in sheave grooves matched to drive.
 - .3 Obtain approval to use cast iron or steel sheaves secured to shafts with removable keys.
 - .4 For 1/3 hp (.25 kW) to 10 hp (7.46 kW) motors, use standard adjustable pitch drive sheaves, having plus/minus 10% range. Use mid-position of range for specified rpm.
 - .5 For over 10 hp (7.46 kW) motors, use sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Specifically refer to Section 23 80 10 for fan requirements relating to V-Belt, vari-pitch drives. Provide sheave of correct size as approved by Consultant to suit balancing.

- .6 Correct size of sheave determined during commissioning.
 - .7 Use minimum drive rating of two times nameplate rating on motor. Keep overhung loads under manufacturer's requirements on all prime mover shafts.
 - .8 With belt drive, provide motor slide rail adjustment plates, allowing for 150mm (6") minimum centre line adjustment.
- .6 Drive Guards
- .1 Provide guards for unprotected drives.
 - .2 Guards for belt drives;
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm (1.5") dia holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
 - .3 Provide means to permit lubrication and use of test instruments with guards in place.
 - .4 Belt guards to be positioned to allow movement of motors for adjusting belt tension.
 - .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fastened in place.
 - .3 Removable for servicing.
 - .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm (3/4") mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fastened in place.
 - .4 Removable for servicing.

- .7 Changing Of Equipment Drives
 - .1 If required, as determined from the review of the preliminary balancing report, changes to the equipment drives shall be carried out as follows:
 - .1 The Balancing Contractor shall be responsible for calculating the new drive requirements.
 - .2 For new equipment, the Contractor who supplied the equipment shall be responsible for obtaining and installing the new drive components.
 - .2 For existing equipment, the Balancing Contractor shall be responsible for obtaining and installing the new drive components.
 - .3 The contract shall include for one drive change for each New Unit with adjustable pulley drive.
 - .1 Additional changes shall be provided as specified in ‘Phasing’.

PART 3 Installation And Execution

3.1 INSTALLATION - GENERAL

- .1 Conform to the requirements of Section 21 05 01 – Mechanical General Provisions
- .2 Install using Manufacturers Recommended Instructions
- .3 Include in the work all requirements of manufacturers shown on the shop drawings.
- .4 Coordinate and Verify spaces in which work is to be installed.
 - .1 Confirm on the site the exact location of outlets and fixtures.
 - .2 Confirm location of outlets for equipment supplied by other trades.
- .5 Replace all work unsatisfactory to the Engineer without extra cost.
- .6 Ductwork, Piping, Equipment, Conduit and Accessories:
 - .1 The piping, ductwork and equipment shown on the drawings is diagrammatic for clearness in indicating the general run and connections, and may or may not be, in all instances, shown in its true position. This does not relieve this Sub-contractor from the responsibility for the proper erection of systems of piping in every aspect suitable for the work intended and as described in the specifications.

- .2 Install items concealed in chases, behind furrings or above ceilings wherever possible.
 - .1 Install exposed systems neatly, and group to present a neat appearance.
 - .2 Install exposed piping, ductwork, equipment, conduit, rectangular cleanouts and similar items parallel or perpendicular to building lines.
 - .3 Install concealed items close to building structure to keep furring space to a minimum.
- .3 Install all ceiling mounted components (Diffusers, Grilles, Sprinklers) in accordance with reflected ceiling drawings, accepted by the Architect.
- .4 Install items in a workmanlike manner to present a neat appearance and to function properly to the acceptance of the Engineer.
- .5 Group items wherever possible and as indicated.
 - .1 Install groups of items parallel to each other on trapeze hangers, spaced to permit service access, application of insulation, and identification.
- .6 Install items straight, parallel and perpendicular to building planes, and close to walls and ceilings, with specified pitch. Use manufactured fittings for direction changes.
- .7 All openings in pipes, ducts and fittings shall be kept plugged or capped during installation, to prevent the entry of dirt and debris and other foreign material.
- .7 Clearances:
 - .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
 - .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.
 - .3 Install all equipment and apparatus requiring wiring, maintenance, adjustment or eventual replacement with due allowance therefore.
 - .4 Leave space clear and install all work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or materials supplied by other trades.

- .5 Install pipe/duct runs etc., to maintain maximum headroom and clearances, and to conserve space in shaft and ceiling spaces.
- .6 Provide clearance for installation of insulation, and access for maintenance of equipment, valves and fittings.
- .8 Protection
 - .1 Protect equipment and system openings from dirt, dust, and other foreign materials with materials appropriate to system.
 - .2 Cover openings in equipment, and cover equipment where damage may occur to the finish from weather or construction.
 - .3 Cover temporary openings in ducts and pipes with polyethylene sheets, until final connection is made.
 - .4 During welding or soldering procedures, provide a fire retardant cloth, mat or blanket to protect the structure, and adequate fire protection equipment at all locations where work is being done. Close off shaft or confined areas with a fire retardant mat or cloth to prevent sparks or pieces of hot metal from falling down the shaft or area way.
- .9 Rigging Of Equipment
 - .1 Provide all rigging, hoisting and handling of equipment as necessary in order to place the equipment in the designated area in the building.
 - .2 Direct this work by qualified people normally engaged in rigging, hoisting and handling of equipment.
- .10 Flashing
 - .1 Flash all mechanical parts passing through or built into an outside wall, or a waterproof floor.
 - .2 Provide copper flashing for sleeves passing through exterior walls or waterproof floors.
 - .3 Provide counterflashing on stacks, ducts and pipes passing through roofs to fit over curb flashing.
- .11 Painting
 - .1 Provide all exposed ferrous metal work on equipment with at least one factory prime coat, or paint one prime coat on the job. Clean up or wire brush all

equipment, etc., before painting. Finish painting will be by other Divisions unless otherwise noted.

- .2 This Sub-Contractor is not required to prime coat or paint ductwork or piping, except to paint gas piping as per code requirements.
- .3 For factory applied finishes, including prime coats, repaint or refinish surfaces damaged during shipment, erection or construction work.

3.2 EXCAVATION AND BACKFILL

- .1 Do all excavation, bedding, backfill and related work required for mechanical work in accordance with the requirements of the General Contractor's specifications, except as varied by this article.
- .2 Grade the bottom of the pipe trench excavation as required.
- .3 In firm undisturbed soil, lay pipes directly on the soil and shape soil to fit the lower 1/3 segment of all pipes and pipe bells. Ensure even bearing along the barrels. Backfill excavation and compact to the following standard Proctor densities:
 - .1 Sodded area, excavated material to 50% P.D.
 - .2 Under paving, sand to 95% P.D.
 - .3 Under Floor slabs, sand to 100% P.D.
- .4 In rock and shale excavate to 150 mm (6") below and a minimum of 200 mm (8") to either side of the pipe. Fill back with a bedding of 10 mm (3/8") crushed stone or granular 'A' gravel.
- .5 Prepare new bedding under the pipe in unstable soil, in fill, and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls of buildings, at manholes, catch basins and sumps. Compact to maximum possible density and support the pipe by 200 mm (8") thick concrete cradle, spanning full length between firm supports.
 - .1 Install reinforcing steel in cradle or construct piers every 2400 mm (8 ft.) or closer, down to solid load bearing strata. Provide a minimum of one pier per length of pipe. Use the same method where pipes cross.
- .6 Where excavation is necessary in proximity to, and below the level of, any footing, provide a bed of 14,000 kPa (2000 psi) concrete to the level of the highest adjacent footing. Proximity is determined by the angle of response as established by the Engineer.
- .7 Provide support over at least the bottom one third segment of the pipe in all bedding methods.

- .8 Do not open trench ahead of pipe laying and bedding more than weather will permit.
- .9 Break up rocks and boulders and remove these by drilling and wedging. Do not use blasting unless specifically approved by the Engineer. Do not use for backfill.
- .10 Do all backfilling in 150 mm (6") layers with clean selected materials acceptable to the Engineer.
- .11 During freezing weather or where frozen material is excavated, backfill with dry sand.
- .12 Provide concrete thrust blocks at each change of direction for underground water piping, as per drawing details.
- .13 Dispose of surplus excavated material as directed by the General Contractor.

3.1 CONCRETE

- .1 Concrete work required for mechanical work and shown on architectural or structural drawings: Provided by General Contractor.
- .2 Concrete work required for mechanical work and not shown on Architectural or Structural drawings - to be provided by this Division.
- .3 Provide in good time, all inserts, sump frames, anchors etc., for mechanical services, required to be built into the forming.
- .4 Provide concrete thrust blocks at each change of direction for underground water piping, as per drawing details.

3.2 METALS

- .1 Steel construction required solely for the work of mechanical trades and not shown on architectural or structural drawings: Provided by this Sub-contractor to the acceptance of the Engineer.

3.3 PREPARATION FOR FIRESTOPPING

- .1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation as per section 07 84 00 - Fire Stopping.
- .2 Uninsulated unheated pipes not subject to movement: No special preparation.
- .3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

- .4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.4 IDENTIFICATION

.1 General

- .1 Install using manufacturer's recommended instructions.
- .2 Provide identification only after painting has been completed.
- .3 The wording shall be the same as the Drawings and Specifications. Prior to ordering, the wording of all equipment tags shall be submitted to the Engineer for review.

.2 Equipment, Panels and Controls:

- .1 Identify all equipment, panels, automatic control devices, etc., with lamacoid name plates.
- .2 Mechanically affix the tags to the equipment using pop rivets or sheet metal screws.
- .3 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .4 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .5 Protection:
 - .1 Do not paint, insulate or cover.

.3 Valves:

- .1 Provide all major valves with brass or Lamacoid numbered tags,
- .2 Prepare an approved list detailing the valve location, tag numbers and purpose it serves.
- .3 Mount one (1) copy of the valve list in a glazed frame where advised by the City of Winnipeg and provide one additional copy in each O & M manual.

- .4 The numbering system shall include the service designation (i.e.: DHW, DCW, HWS, HWR, etc.). The service designations shall be the same as the Drawings.
- .5 Number valves in each system consecutively.
- .4 Piping:
 - .1 Identify all piping as to service and direction of flow:
 - .2 The service designations (i.e.: DHW, DCW, HWS, HWR, etc.) shall be the same as the Drawings and Specifications.
- .5 Location Of Identification On Piping Systems:
 - .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 9 m (30') intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
 - .2 Adjacent to each change in direction.
 - .3 At least once in each small room through which piping or ductwork passes.
 - .4 On both sides of visual obstruction or where run is difficult to follow.
 - .5 On both sides of separations such as walls, floors, partitions.
 - .6 Behind each access door
 - .7 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
 - .8 At beginning and end points of each run and at each piece of equipment in run.
 - .9 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
 - .10 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.
- .6 Special Signage

- .1 Confirm wording of signage with City of Winnipeg prior to ordering.
- .2 Supply Signage to City of Winnipeg for City of Winnipeg's installation.

3.3 BUILDING ENVELOPE INTEGRITY

- .1 Avoid penetrating through building envelope air barrier. Where penetrations are necessary, maintain integrity of air barrier using suitable materials.
- .2 For additional requirements, see Section 07 26 00 – Vapour Retarders & 07 27 00.02 – Air Barriers-Performance.
- .3 Coordinate with Architect for repair of building envelope at all locations where envelope has been penetrated as result of removal and/or relocation of existing equipment, piping, ductwork, conduit, cable, wiring, etc.

3.4 INSTALLATION OF MECHANICAL SERVICES

- .1 Except for final runouts on sanitary waste piping to discharge from fixtures and floor drains, all mechanical services (ductwork, piping, tubing, etc.) shall be run on the square, parallel with building structure. Sanitary waste mains shall also be run in this manner, unless approved otherwise by Consultant.

3.5 ACCESSABILITY OF EQUIPMENT

- .1 Safely and efficient access shall be provided to system equipment for replacement/repair.
 - .1 All equipment must be accessible,
 - .1 Ceiling mounted equipment shall only be considered accessible if a tradesman can place both hands on the component which requires servicing (i.e. fan motor, belt, pulley, bearings, fire damper linkage, valve/control valve, strainer or any other equipment component which requires periodic maintenance). The component must be in clear view, and access must be gained from an 8 foot step ladder.
 - .2 Access panels provided in drywall shall be sized and placed in such a manner that a tradesman can place two hands on the component as stated above. Equipment located above acoustic tile ceilings shall be positioned in such a manner that equipment and components can be accessed through a full tile which does not contain any building system services; notify the Consultant if unable to do so.

- .2 Conduit, pipe, ducting and support members, or any other obstructions to accessibility shall be relocated at the Contractor's expense, by the contractor's forces.

3.6 COORDINATION DRAWINGS

- .1 Prepare interference and coordination drawings for all areas, wherever there is possible conflict and/or obstruction due to the positioning of mechanical equipment, piping, wiring, ductwork, or other work of this Division relative to other trades.
- .2 Prepare drawings in conjunction with other trades
- .3 Show all sleeves and openings for passage through structure, and all inserts, equipment bases, sumps, pits and supports, and relate these to suitable grid lines and elevation datum.
- .4 Submit drawings for Consultant's review.
- .5 Drawings shall be to a scale sufficient to show the necessary details. Submit to the Consultant and City of Winnipeg for review. Distribute drawings after review, to trades affected.
- .6 Prepare fully dimensioned detail drawings of shafts, duct spaces, pipe spaces and tunnels. Show holes and sleeves, and include information pertaining to access, clearances, tappings, drains and electrical connections.
- .7 Base information used to prepare drawings on certified shop drawings.
- .8 Prepare, and submit for review, scale drawings of equipment bases, anchors and their relationship to structure, inertia slabs, floor and roof curbs, which pertain to Division 21,22, & 23 work and which are not shown on Architectural or Structural Drawings.

3.5 WIRING AND MOTORS

- .1 Fasten motors securely in place.
- .2 Make motors removable for servicing, easily returned into, and positively in position.

3.6 HANGERS AND SUPPORTS

- .1 General:
 - .1 Install hanger so that rod is vertical under operating conditions.
 - .2 Adjust hangers to equalize load.

- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Hanger rods may be attached to beam or joist clamps, brackets, or concrete inserts. Explosive actuated tools are not permitted. Do not weld to structural steel unless Engineer's approval is given.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
 - .1 vertical movement of pipework is 13 mm (1.2") or more,
 - .2 transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
 - .1 transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 variation in supporting effect does not exceed 25 % of total load.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with concrete inserts, one at each corner.
- .1 Hanger Spacing

- .1 Plumbing piping: to Plumbing Code and authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to DN 15 (NPS ½): every 1.8 m.
- .4 Copper piping: up to DN 15 (NPS ½): every 1.5 m.
- .5 Within 300 mm of each elbow.
- .6 The following tables will determine support points for all piping on this installation:

<u>STEEL PIPE:</u> <u>SUPPORTS</u>	<u>NOMINAL SIZE</u>	<u>DISTANCE BETWEEN</u>
	Up to DN 32 (NPS 1.25)	2,400 mm (8 ft.)
	DN 40 – 65 (NPS 1.5 - 2.5)	3,000 mm (10 ft.)
	DN 80 (NPS 3) and over	3,600 mm (12 ft.)

<u>COPPER PIPE:</u> <u>SUPPORTS</u>	<u>NOMINAL SIZE</u>	<u>DISTANCE BETWEEN</u>
	Up to DN 20 (NPS ¾)	1,800 mm (6 ft.)
	DN 20 – 25 (NPS ¾ – 1)	2,400 mm (8 ft.)
	DN 32 – 50 (NPS 1.25 – 2)	3,000 mm (10 ft.)
	DN 65 (NPS 2.5) and over	3,600 mm (12 ft.)

- .5 Horizontal Movement
 - .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
 - .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.
- .6 Final Adjustment
 - .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
 - .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.

- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 INSERTS, SLEEVES AND ESCUTCHEONS

- .1 General:
 - .1 Supply and locate all inserts, holes, anchor bolts and sleeves in time when walls, floors and roof are erected.
- .2 Inserts
 - .1 Place inserts only in portion of the main structure and not in any finishing material.
 - .2 Do not use explosive powder activated tools except with the written permission of the Engineer.
- .3 Sleeves
 - .1 Install where pipes and ducts pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
 - .2 Walls: Terminate flush with finished surface.
 - .3 Floors: extend 100 mm (4") above the floor, and cut flush with the underside.
 - .4 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
 - .5 Insulation:
 - .1 For interior, non-fire-rated walls and floors: Insulation shall be continuous through sleeve.
 - .2 For Exterior Walls and Fire-rated walls and floors: Stop insulation flush with wall surfaces.
- .6 Sealing:

- .1 Ensure no contact between pipe/tube and sleeve.
- .2 Foundation walls and below grade floors:
 - .1 Fire retardant, waterproof non-hardening mastic.

- or -
 - .2 co-operate with the Waterproofing trade and apply an approved caulking compound over ram-packed mineral wool on both sides. Over this, on both sides, apply a layer of glassfab tape imbedded in two coats of an approved mastic compound.

- or -
 - .3 Provide a 'Link-Seal' gasket.
- .3 Through Rated Shaft and Equipment Room walls and floors:
 - .1 seal space between duct/pipe and sleeve with ram packed mineral wool and apply an approved caulking compound over the mineral wool on both sides.
 - .2 Maintain fire rating integrity.
 - .1 Provide space for firestopping.
 - .2 Provide intumescent 'donut(s)' for piping.
- .4 Through floors of Kitchens and Janitor's closets:
 - .1 seal space between duct/pipe and sleeve with ram packed mineral wool and apply an approved caulking compound over the mineral wool on both sides.
 - .2 seal as described above for Equipment Room Walls.
- .5 Interior walls and floors not noted above:
 - .1 seal space between duct/pipe and sleeve with ram packed mineral wool.
- .6 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

- .7 Through all walls: Stop insulation flush with all wall surfaces and seal space between duct or pipe and sleeve with ram packed mineral wool.
- .4 Escutcheons
 - .1 Install on pipes and ducts passing through walls, partitions, floors, and ceilings in finished areas.
 - .2 Cover sleeves and openings around exposed piping in all finished areas with split chrome plated escutcheons.
 - .3 Cover exposed duct sleeves in finished areas with an 18 gauge galvanized steel collar fixed to wall or floor.

3.8 PIPE INSTALLATION

- .1 Install brass and copper pipe tubing free from surface damage. Replace damaged pipe or tubing.
- .2 Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.
- .3 Where steel piping is required to be buried, apply two coats of flint-guard 410-02 (or equal) bituminous paint to all buried surfaces after assembly and testing.
- .4 Install piping to avoid any interference with the installation of equipment, other piping, ducts etc. Where it is necessary to offset piping to avoid obstructions, use 45 degree rather than 90 degree elbows.
- .5 Provide long turn pipe fittings not less than pipe wall thickness. Provide line size tees, and where branch lines are more than two sizes smaller than the main, weldolets may be used.
- .6 Install systems so that they can be thoroughly drained and all air eliminated. Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.
- .7 Provide hose end valves at all low points for complete system drainage, whether shown on the drawings or not.
- .8 Slope all condensate drip drains, and provide suitable cleanouts on every other change in direction.
- .9 Ream the ends of pipes and tubes before installation. Clean the ends of pipes/tubing, and the recesses of fittings to be brazed or soldered. Assemble joints without binding.

- .10 Make all threaded pipe joints using a thread paste or teflon tape applied to the male thread. Use only non-toxic lubricants which are non-injurious to the gasket material, and suitable for the service for which the pipe is to be used. Use of hemp or similar materials on threaded joints will not be permitted.
- .11 Place all valves and specialties to permit easy operation and access.
- .12 Install gauges and thermostats to permit easy observance.
- .13 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.
- .14 Regulate and adjust all packing glands, regulating valves and relief valves on completion of the work.
- .15 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .16 Assemble piping using fittings manufactured to ANSI standards.
- .17 Install Cold piping below and away from hot piping so as to maintain temperature of cold water as low as possible.
- .18 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .19 Screwed fittings jointed with Teflon tape.
- .20 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .21 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .22 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .23 Ream pipes, remove scale and other foreign material before assembly.
- .24 Provide for thermal expansion as required.
- .25 Low Point Drain Valves:

- .1 Install piping with grade in direction of flow except as indicated.
 - .2 Provide hose end valves at all low points for complete system drainage, whether shown on the drawings or not.
 - .3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.
 - .4 Drain valves: DN 20 (NPS ¾) gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.
- .26 Provide Dielectric Couplings where dissimilar metals are joined.
- .27 Gas Piping
- .1 Install drip points:
 - .1 At low points in piping system.
 - .2 At connections to equipment.

3.7 MISCELLANEOUS DRAINS

- .1 Pipe all discharge from relief valves to the floor, in the vicinity of a floor drain.
- .2 Pipe all discharge from drain pans and drain valves to the nearest floor drain or suitable receptacle.
- .3 Provide DN 20 (NPS ¾) ball valves with hose end outlets at strainers, all low points, at pumps, coils and at each piece of equipment.

3.9 EQUIPMENT INSTALLATION

- .1 General:
 - .1 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
 - .2 Allow for isolation and removal of equipment without interrupting operation of other equipment or systems.
 - .3 Install piping connections to pumps and all other equipment without strain at the pipe connection to this equipment. Where requested by the Engineer, remove the

bolts in flanged connections, or disconnect the piping after the installation is complete, to demonstrate that the piping has been so connected.

- .4 Provide double swing pipe joints.
- .5 Clean finned tubes and comb straight.
- .6 Provide supplementary suspension steel as required.
- .7 Check final location with City of Winnipeg if different from that indicated prior to installation.
 - .1 Should deviations beyond allowable clearances arise, request and follow Engineer's Consultant's directive.

.2 Equipment Connections:

- .1 Install isolation valve on inlet and outlet, balancing valve on outlet, and control valve (when specified) on inlet.
- .2 Install drain valve at low point and manual air vent at high point. Install between equipment and isolation valves.
- .3 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
 - .1 All fittings DN 50 (NPS 2) and below connecting to equipment: use unions, extra heavy duty pattern, having ground joints, brass seats and diagonal screw.
 - .2 Connections to equipment DN 65 (NPS 2.5) and above: Flanged, standard weight provided with ring gaskets.
- .4 Install the shut-off valves and flanges/unions, in locations so as to permit the removal of the equipment without disturbing the piping systems.

3.10 VALVES

.1 General:

- .1 Install in accessible locations.
- .2 Valves accessible for maintenance without removing adjacent piping.
- .3 Locations:

- .1 Install gate, ball or butterfly valves at branch take-offs, and to isolate each piece of equipment, and as indicated.
 - .1 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.
 - .2 Isolate equipment, fixtures and branches with valves.
- .2 Install globe valves for balancing and in by-pass around control valves as indicated.
 - .1 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.
- .3 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
- .4 Install swing check valves in horizontal lines on discharge of pumps and as indicated.
- .5 Install plug cocks or ball valves for heating water service.
- .4 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
- .5 Handle valve with care so as to prevent damage to disc and seat faces.
- .6 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.
- .7 Install valves with stems upright or above horizontal unless otherwise approved by Engineer.
- .8 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.
- .9 Install rising stem valves in upright position with stem above horizontal.
- .10 Install chain operators on valves DN 65 (NPS 2.5) and over where installed more than 2400 mm above floor in Mechanical Equipment Rooms.
- .11 Preparation
 - .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.

- .2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
 - .3 Verify suitability of valve for application by inspection of identification tag.
 - .4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.
 - .5 Remove interior parts before soldering.
- .2 Butterfly Valves
- .1 Install butterfly valves with disc in almost closed position.
 - .2 Install butterfly valves between weld neck flanges to ensure full compression of liner.
- .3 Lubricated Plug Valves
- .1 Valve Operation:
 - .1 Determine the type of sealing compound for particular application.
 - .2 Open and close valve at least 3 times to ensure distribution of sealing compound evenly and to ensure tight shut-off.
 - .3 When operating valve, ease valve off body to ensure that plug is free to float.
 - .4 Determine frequency of re-lubrication during commissioning of remainder of system.

3.11 AIR VENTS

- .1 Provide air vents on closed-loop water piping at all high points in the system and at each piece of equipment. Provide shut off cocks to automatic vents.
- .2 Provide automatic air vents on piping mains except where a possibility from water damage would occur, in which case, use manual vents.
- .3 Provide manual air vents at each piece of equipment.
- .4 Install isolating valve at each automatic air valve.

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

3.12 CONTROL COMPONENTS

- .1 Mount all pipe line devices supplied by the control sub-contractor such as flow switches, valves, separable wells for temperature controllers and sensors.
- .2 Install control devices to guarantee proper sensing. Shield elements from direct radiation and avoid placing them behind obstructions.

3.13 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to testing, flushing/cleaning, and start-up.
- .2 Verify that systems can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.
- .5 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
- .6 Check gas trains, entire installation is approved by authority having jurisdiction.

3.14 PIPING SYSTEM TESTS

- .1 After pre-start inspection, and prior to flushing and cleaning, systems shall be pressure tested.
 - .1 Advise Engineer prior to performance of pressure tests.
 - .2 Conduct tests in presence of Engineer.
- .2 Do not insulate or conceal piping systems until completed, perfected, and proven tight.
 - .1 Pressure test buried systems before backfilling.
 - .2 Insulate or conceal work only after approval and certification of tests by Engineer.

- .3 Should leaks develop in any part of the piping system, remove and replace defective sections, fittings, etc.
 - .1 Pay costs for repairs or replacement, retesting, and making good. Engineer to determine whether repair or replacement is appropriate.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Test piping systems and prove tight.
 - .1 Test piping system in sections as required by the progress of this and other contractors work and provide all required isolating valves.
 - .2 Test all drain and vent piping pneumatically to a pressure of 14 kPa (2 psi) and prove tight for a period of 1 hour.
- .6 Maintain specified test pressure without loss for the time noted, unless a longer period of time is required by code.
- .7 Drain Waste And Vent Piping:
 - .1 Use Ball Test, or Hydraulically test to verify grades and freedom from obstructions.

3.15 SAFETY DEVICE TESTING

- .1 Make complete inspections of all safety devices such as: back flow preventors, fire extinguishers, hose cabinets; freeze protection devices; fire dampers, smoke dampers, fire stops, and the like to ensure:
 - .1 That safety devices are complete in accordance with the specifications and Manufacturer's recommendations.
 - .2 That the safety devices are connected and operating according to all local regulations, and appropriate access is provided.
- .2 On completion of the inspections, provide letters and/or certificates, confirming that inspections have been completed. Insert in each O & M Manual.

3.16 VIDEO INSPECTION (Storm Piping)

- .1 Video inspection shall be carried out by a qualified contractor with a minimum of three (3) years previous experience, with the following equipment:

- .1 Camera:
 - .1 High-resolution color with adjustable iris focus.
 - .2 Integral lighting suitable to provide illumination and a clear video image of the entire periphery of the pipe.
 - .3 Capable of operating in 100% humidity conditions.
 - .4 Produce a high quality video image.
- .2 Provide closed-circuit video inspection equipment capable of displaying on-screen footage of distance measured to within 1% of actual distance.
- .3 Record the inspection in color in the recording media specified. Forward the recording to the Consultant.
- .2 General:
 - .1 Conduct video inspection of all new and rehabilitated interior/exterior storm sewers after all backfill and compaction operations are completed, but prior to paving.
 - .2 Notify the Engineer the day prior to inspection so the Engineer may be present during the inspection.
 - .3 Low spots holding water in excess of 25mm (1”) or 5% of the pipe diameter, whichever is less, will be considered unacceptable.
 - .4 If unacceptable low spots exist, as indicated by standing water during video inspection, remove and replace sewer as necessary and re-inspect.
- .3 Inspection Procedure:
 - .1 Prior to video inspection, run sufficient water through the pipe to saturate potential low spots so they may be detected during inspection.
 - .2 Inspect each pipe segment between manholes or access points in a single, continuous run. Progress through the entire project in a uniform direction.
 - .3 Inspect all lateral connections and other observations at right angles utilizing the pan and tilt capabilities of the camera.
 - .4 Center the video camera in the pipe during the inspection.
 - .5 Do not exceed 9.14m (30 feet) of inspection per minute.
- .4 Inspection Reporting:
 - .1 Provide a copy of the video inspection including on-screen continuous footage, pipe diameter, direction of viewing, cleanout location reference and/or manhole and street location references in the recording. Affix labels to the recording media to include the name of the project, the date, and the location of the inspection.
 - .2 Provide a written report of the inspection. In the report, include true-to-scale drawings of all sewer defects and observation locations. Reference the time stamp on each line item entry on the written report.

3.17 COMMISSIONING

- .1 Provide equipment, personnel, material and information necessary to assist the Commissioning Agent in completing the Commissioning Process.
- .2 Piping:
 - .1 Test performance of all components.
 - .2 Ensure all Valves are installed correctly, located where required, are operational, and are left in their final operating position.
 - .3 Measure and Adjust Pressure Regulating and Pressure Relief Valves
 - .4 Monitor Piping systems for freedom of movement and pipe expansion.
 - .5 Ensure piping has applicable labels and flow arrows.
- .3 Equipment:
 - .1 Ensure proper installation of controls.
 - .2 Before acceptance, set discharge patterns and fan speeds to suit requirements.
 - .3 Plumbing Fixtures:
 - .1 Test to ensure traps are fully and permanently primed.
 - .2 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .4 Valves:
 - .1 Ensure Back Water Valves are located where required, are accessible and operational.
 - .2 Ensure Isolation Valves and Pressure Regulating Valves are installed correctly, located where required, are operational, and are left in their final operating position.
 - .3 Ensure Safety Valves such as Backflow Preventors and Relief Valves are installed correctly, located where required, are operational, and are left in their final operating position. Confirm provision of Testing Tag and information.
 - .4 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

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

END OF SECTION

PART 1 General

1.1 GENERAL REQUIREMENTS

- .1 Comply with the requirements of Section 21 05 01, Mechanical General Provisions.
- .2 Comply with the requirements of Section 21 05 05, Basic Materials and Methods.
- .3 Comply with the requirements of Sections 22 06 01, Approved Substitutes for Plumbing.

1.2 WORK PERFORMED UNDER THIS SECTION

- .1 As indicated on the Drawings and in the Specifications, provide complete plumbing systems with all necessary appurtenances, trim and piping, including, but not limited to:
 - .1 Re-work and modifications to the existing weeping tile pits (x2) pumped discharge piping;
 - .2 New Storm drainage piping tie in from the existing weeping tile pits (x2) pumped discharge piping;
- .2 Provide Equipment, Personnel and Material necessary to assist with Pipe Cleaning and Chemical Treatment.

1.3 START-UP AND COMMISSIONING

- .1 Start-up and Commissioning shall be undertaken prior to the Occupancy stage of each Construction Phase.
- .2 Provide the Equipment, Personnel and Material necessary to put the Plumbing Systems into Operation.
- .3 Provide the Equipment, Personnel, Material and Information necessary to assist the Mechanical Contractor in completing the Commissioning Process.

1.4 QUALITY ASSURANCE

- .1 Qualifications: Execute work of this section by skilled tradesmen regularly employed in the installation of plumbing and drainage systems.

1.5 SUBMITTALS

- .1 Submit shop drawings on plumbing fixtures/trim, drains and associated accessories; and humidifiers and accessories.

PART 2 Products And Materials

2.1 PRESSURE RELIEF AND REGULATING VALVES

- .1 Where indicated or performance specified on the drawings, provide pressure relief and regulating valves as follows.
- .2 Acceptable Manufacturers: Watts, Singer, Honeywell, Braukmann, Wilkins, Conbraco.
- .3 For natural gas, provide CGA approved pressure regulating valves as manufactured by Fisher or Canadian Meter.

2.2 CLEANOUTS AND ACCESS COVERS

- .1 All cleanouts and access covers shall be suitable for heavy duty traffic.
- .2 Provide cleanouts and access covers suitable for the specified floor finish.
- .3 All floor access covers shall be set flush with the finished floor.
- .4 Access covers shall be polished nickel bronze with V.P. screws.
- .5 Exposed cleanouts shall be standard M.J. or Bell and Spigot cleanout plugs with no access cover.
- .6 Cleanouts concealed behind walls or above non-removable ceilings shall be standard M.J. or Bell & Spigot cleanout plugs with suitable access doors.
- .7 Cleanouts in finished floors shall be standard M.J. or Bell & Spigot cleanout plugs with manufactured covers to suit the floor finish. Access covers equal to Ancon or Zurn will be acceptable. Access covers shall have recessed pans for accepting the floor finish (carpet or tile) in finished areas with flooring.

PART 3 Installation And Execution

3.1 GENERAL

- .1 Install all fixtures, drains, cleanouts, equipment, etc., as per manufacturer's requirements.

3.2 SPECIALTIES INSTALLATION

- .1 Cleanouts:
 - .1 Install accessible cleanouts at traps where required.
- .2 Pressure/Temperature Relief Valves:
 - .1 Provide drain to +/- 100mm (4") above finished floor.

3.3 TESTING

- .1 Test piping in accordance with the procedures outlined in Section 21 05 05 – Basic Materials and Methods.
- .2 Ensure that insulated piping and equipment installed in concealed places is tested and inspected prior to permanent concealment.

3.4 START-UP AND COMMISSIONING

- .1 Prior to the Occupancy Stage of each Construction Phase:
 - .1 Start up the Equipment and Systems as per Specification Section 23 08 05.
 - .2 Calibrate and adjust all items provided under this contract.
 - .3 Assist in the commissioning Process as required. Refer to Specification Section 23 08 05.
 - .4 Provide instructions to the City of Winnipeg as required. Refer to Specification Section 21 05 01 – Mechanical General Provisions.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

- .1 Section 21 05 01, Mechanical General Provisions.
- .2 Section 21 05 05, Basic Materials and Methods.

1.2 APPROVED 'SUBSTITUTES' AND 'ALTERNATES'

- .1 Where a Manufacturer's name, make, model, and/or size is specified, it is for the purpose of setting a standard of quality, performance, capacity, appearance and/or serviceability, and is acceptable without qualification. Manufacturers listed as acceptable 'Substitutes' have been deemed by the Consultant as capable of producing equipment and/or material of comparable quality, performance and approximate dimensions, and can be used in the preparation of the tender. Where no substitutes are indicated, provide the exact make specified or provide the necessary documents for review.
- .2 'Substitute' equipment and material is deemed to be interchangeable with that specified, with little or no revisions required to the design intent and/or other items, equipment or connections.
- .3 'Alternate' equipment and material is deemed to be acceptable but which will require major revisions to the design intent and/or other items, equipment or connections.
- .4 Requests for approval of additional 'Substitutes' or 'Alternates' must be submitted not less than ten (10) days prior to closing date of the tender, and submissions must bear proof of acceptance by the Consultant if used in the tender. Requests shall include all performance, capacity, appearance, weight, connections, power and wiring requirements, etc required for the Consultant to make a complete evaluation.
- .5 Assume full responsibility for ensuring that, when providing accepted 'Substitutes' and/or 'Alternates', all space, weight, connections, power and wiring requirements, etc. are considered and adjusted costs are included in the tender. The Mechanical systems have been designed based on the equipment/materials of the specified manufacturer(s). The onus shall be on the Subcontractor (along with his sub-sub-contractor and the supplier) to ensure that 'Substitute' or 'Alternate' equipment/materials will meet the required performance and electrical characteristics, as well as fit properly into the allotted space, including allowance for required access and servicing. Any additional costs incurred as a result of modifications to the system(s) or the room layout, or modifications required by other trades, shall be borne by the Subcontractor (along with his sub-sub-contractor and the supplier) and shall be deemed to be included in the tender price.
- .6 Bidders must base their price on specified manufacturers or approved 'Substitutes'. 'Alternates', when allowed, must be listed separately, with the amount to be added or subtracted for each substitution. If in the preparation of the tender, this Subcontractor neglects to name the manufacturer of an accepted 'Alternate', it will be understood that specified or 'Substitute' equipment will be provided.

- .7 If, in the opinion of the Consultant, 'Substitute' equipment/material submitted for review as Shop Drawings is not satisfactory, satisfactory equipment/material of the specified or an accepted 'Substitute' manufacturer must be re-submitted.
- .8 If, in the opinion of the Consultant, 'Alternate' equipment/material submitted for review as Shop Drawings is not satisfactory, satisfactory equipment/material of the specified or an accepted 'Substitute' manufacturer must be re-submitted.

1.3 APPROVED 'SUBSTITUTES'

- .1 The following is the list of pre-approved 'Substitutes':
- .1 Air Vents: Hamlet and Garneau; Bell and Gossett; Dole;
Maid-O-Mist; Armstrong; Braukman;
 - .2 Chemical Treatment: Bird Archer; Calgon;
Dearborne; Mogul; Drew Chemical;
 - .3 Cleanouts: Ancon; Smith; Zurn; Mifab;
 - .4 Expansion Fittings & Loops Flex-Hose
 - .5 Level and Flow Switches: Magnetrol;
 - .6 Pressure Relief Valves,
Pressure Regulating Valves: Conbraco; Beeco; Febco; Watts;
Kunkle; Taylor; Consolidated; Zurn;
Fisher; Singer; Crosby-Ashton;
Boylston; Lonergan; Masoneilan; Wilkins
 - .7 Valves (General): Crane; Kitz; Apollo; Newman-Hattersley;
Nibco; Toyo; Jenkins; American Valve;
Anvil; KVC;
 - .8 Valves (Ball): Worcester; TrueLine;;
 - .9 Valves (Butterfly): Kitz; Nibco; Jenkins; Newman-
Hattersley; Apollo; Dezurik; Keystone;
Crane; TrueLine; KVC; Challenger;
 - .10 Valves (Check): Centerline; Hagen; Mueller; Moyer and
Groves; Singer; Dezurik; Crane; Apco;
KVC; Uni-chek
 - .11 Valves (PVC): Chemline;

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

- .1 Comply with the requirements of Section 21 05 01, Mechanical General Provisions.
- .2 Comply with the requirements of Section 21 05 05, Basic Materials and Methods.
- .3 Comply with the requirements of Section 22 05 05, Plumbing.

1.2 SCOPE OF WORK

- .1 Make provisions to supply & install one (1) new space humidity sensor located in the existing crawlspace as shown on the submitted mechanical renovation drawings. New humidity sensor shall be connected to existing Direct Digital Controls (DDC) systems for monitoring of humidity levels in crawlspace as noted in the mechanical specifications.
- .2 The Bill & Helen Norrie Library facility is interconnected with the City of Winnipeg's existing Metasys ADX Extended Application and Data Server.
 - .1 The Contractor must become familiar with the existing systems and must be capable of connecting to this existing systems.
- .3 Include for all relevant control/indication, hardware, software, etc. as required to complete only the scope of work noted above. Control components and interconnecting systems to be installed by trained control mechanics, regularly employed by Division 25 00 00.
- .4 Refer to control sequences and/or input/output schedules for points to be connected to existing City of Winnipeg system.
- .5 Refer to drawings, detail sheets and individual clauses in this section for points to be connected to control system. All points connected to DDC control panels shall be connected to existing City of Winnipeg system.
- .6 Provide labour, materials, equipment and services necessary for, and incidental to the supply and installation of the new systems shown on the drawings and described in this specification, so as to leave the City of Winnipeg with a complete and functioning system.
 - .1 The Contract Documents are performance based, diagrammatic and approximately to scale, intended to convey the scope of work and indicate the general arrangement and approximate location of equipment and components. Not all accessories and components have been shown or specified.

- .2 Even though the work is not completely shown, or is shown schematically, and all details are not shown or specified, it is expected that the contractor be familiar enough with his field of work to complete the project to the standards generally adhered to by the local industry, including good workmanship and common sense.
- .3 Provide both office and field engineering to develop a complete and comprehensive control system, based on the outline specifications and system schematics.
- .4 It shall be the responsibility of the Controls Contractor to provide the detailed sequence of operation and the appropriate equipment and accessories, subject to acceptance by the Consultant.
- .5 Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.
- .6 Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.
- .7 Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.
- .8 Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.
- .9 Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.
- .10 Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.
- .11 Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.
- .12 Provide a comprehensive operator and technician training program as described herein.
- .13 Provide as-built documentation, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

- .14 Provide new sensor. No used components shall be used as any part or piece of installed system.
- .7 Provide equipment, personnel and materials necessary to assist with air and hydronics balancing.
- .8 Provide all miscellaneous devices as required to interface with the building mechanical systems and to make a complete operable system.

1.3 GENERIC INPUT/OUTPUT FOR METASYS CONTROL

- .1 Controls must be able to interface to MSEA technology on the field device network using BACnet Protocols.
- .2 Supervisory Controller to be integrated to existing City of Winnipeg ADX server.
- .3 No LON protocols are to be accepted.
- .4 Controls contractor to provide commissioning sheets for all points on field devices.
- .5 Controls contractor to communicate with equipment provider to ensure proper field point integration as well as controllability of the equipment, if not package controls.
- .6 Controls contractor to supply all drawings/graphics/sequence of operations in both a hard and digital copies. Drawings and graphics shall be able to be read and be modified by City of Winnipeg Staff. User interface graphics to be completed using Graphic Generation Tool software. Graphics must use City of Winnipeg graphic templates. Contractor to supply As-Built drawings in an editable format, able to be easily edited by City of Winnipeg Staff.
- .7 If other vendor (non-JCI) controls are to be used then a seamless integration must be proven before approval will be given.
- .8 A complete list of set-points must be provided.
- .9 Alarm Messages. All objects that must be alarmed will have in the alarm message text the following information as per the included example. Alarm Message: Building Address, What is in alarm, see graphic for Instruction Example: 251 Donald SF-1 VFD Common Alarm, see graphic for Instruction.
- .10 General:
 - .1 The term BACnet refers to an industry standard protocol which complies with ASHRAE, and must be listed with the BACnet International / BACnet Testing Laboratories (BI/BTL). This basically states that all devices using the BACnet

technology will be able to communicate to each other. The controls contractor performing the controls installation should confirm that all devices specified are able to communicate to the proposed devices. Supply documentation such that all devices supplied will communicate to each other as required for proper operation of the system (PICS Statement, BI/BTL Listing, and ASHRAE listings).

- .2 The City of Winnipeg shall not be required to update/upgrade the existing ADX server in order for all user views, alarms, and point monitoring to occur. The controls contractor must co-ordinate with City staff for all installations. All user views and graphics must not be installed in the local supervisory controller (NAE/NIE/NCE). All such items must be programmed into the existing ADX server. User views and graphics must be approved for use by City staff before implementation of such items.
- .3 All monitored points that have alarms must have operating instructions and alarm messages. These will be co-ordinated with the tech shop and operations supervisor.

1.4 ALTERNATE CONTRACTORS

- .1 This specification is prepared on the basis that the specified BAS/BMS/DDC systems & equipment shall be capable of the control and monitoring of mechanical systems as outlined.
- .2 Alternate Suppliers/Contractors will be required to submit qualifications, product data or all other pertinent information to prove ability and competency in the provision of a fully integrated and functional system.

1.5 QUALITY ASSURANCE

- .1 The controls systems shall be designed, installed, commissioned, and serviced by manufacturer authorized and trained personnel.
 - .1 The controls contractor shall be regularly engaged in the design, installation and maintenance of BAS systems and shall have demonstrated technical expertise and experience in the design, installation and maintenance of BAS systems similar in size and complexity to this project.
- .2 Materials and equipment shall be manufacturer's latest standard design that complies with the specification requirements.
- .3 All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

- .4 All equipment and materials shall be new and C.S.A. approved, unless specifically noted otherwise.
- .5 All similar equipment and or materials shall be by the same manufacturer.
- .6 All aspects of the installation must comply with the most stringent of the applicable building codes, local regulations, and by-laws.

1.6 REFERENCE STANDARDS

- .1 The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
 - .1 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
 - .2 ANSI/ASHRAE Standard 135, BACnet.
 - .3 Uniform Building Code (UBC), including local amendments.
 - .4 UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
 - .5 National Electrical Code (NEC).
 - .6 FCC Part 15, Subpart J, Class A.
 - .7 EMC Directive 89/336/EEC (European CE Mark).
 - .8 UL-864 UUKL listing for Smoke Controls for any equipment used in smoke control sequences.
- .2 City, provincial, and federal regulations and codes in effect as of contract date.
- .3 Except as otherwise indicated, the system supplier shall secure and pay for all permits, inspections, and certifications required for his work, and arrange for necessary approvals by the governing authorities.

1.7 SUBMITTALS & SHOP DRAWINGS

- .1 Submit shop drawings prior to installation, consisting of product and sizing data for all equipment and components, and proposed control software and sequences including, but not limited to:

- .1 Drawings:
 - .1 The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
 - .2 Drawings shall be available electronically in PDF format.
- .2 System Documentation:

Include the following in submittal package:

 - .1 System configuration diagrams in simplified block format showing the system architecture;
 - .2 System schematic diagrams and wiring layouts;
 - .3 All input/output object listings and an alarm point summary listing;
 - .4 Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification;
 - .5 Complete bill of materials, valve schedule and damper schedule;
 - .6 Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items;
 - .7 Overall system operation and maintenance instructions—including preventive maintenance and troubleshooting instructions;
 - .8 Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system;
 - .9 A list of all functions available and a sample of function block programming that shall be part of delivered system;
 - .10 Sensors and control components;
 - .11 Miscellaneous components;
 - .12 Control panel locations and layout;
 - .13 Detailed written sequences of operation;
 - .14 Logic flow charts;
 - .15 Lists of menus and alarms;
 - .16 Sample menu and alarm formats.

- .2 The Logic Flow Charts submitted as part of the shop drawings, using computer industry standard symbols and nomenclature, shall be developed so as to:
 - .1 Clarify the program code for the Consultant and the City of Winnipeg;
 - .2 Demonstrate that the programmer understands the intent of the specifications;
 - .3 Clearly indicate the programming sequences.
- .2 The Contractor shall provide a copy of the preliminary shop drawings directly to the Consultant's office for review and comment, make any changes requested by the Consultant, and re-submit copies. Submission and re-submission shall continue in this manner until the preliminary shop drawings have been accepted by the Consultant. Seven copies of the final shop drawings shall be prepared and submitted through the normal channels of communication.
- .3 The review of the shop drawings is for the sole purpose of ascertaining conformance with the general design concept. The review shall not mean approval of the detailed design inherent in the equipment, the responsibility for which shall remain with the Contractor. The review shall not relieve the Contractor of the responsibility to meet the requirements of the contract documents. The Contractor shall remain responsible for confirming and correlating the dimensions on the jobsite, and for information that pertains to the fabrication process, construction techniques, and installation details, and for coordinating the work with the other Contractors.

1.8 IDENTIFICATION OF EQUIPMENT - GENERAL

- .1 Refer to Section 21 05 05 – Basic Materials & Methods.
- .2 Provide identification plastized “luggage tag” for field devices (not local thermostats) which are part of control systems.
- .3 All manual switches, unless they come with standard nameplates, shall be labelled with lamacoid.
- .4 Equipment installed on surface of local panels shall be labelled with lamacoid identification plates.
- .5 Equipment mounted inside local panels, must have permanent labels 13mm white with black lettering. i.e. P-Touch labels.
- .6 Lamacoid plates shall be black background with minimum 5mm high white letters, unless specified otherwise.

- .7 Lamacoids shall be of size to accommodate lettering.
- .8 Fasten lamacoid identification plates with rivets or self-tapping screws. Locate adjacent to device if there is not adequate space.
 - .1 Plastized “Luggage Tag” to list:
 - .1 Point Keyname
 - .2 Point Technical Address
 - .3 Point Type
 - .4 Point Description
 - .5 Device Part Number
- .9 In general, information on lamacoid identification plates and plastized “luggage tag” to be consistent with `as-built' control drawings.
- .10 Prior to lamacoid and plastized “luggage tag” fabrication, submit copies of control drawings and complete list of proposed wording for each lamacoid and plastized “luggage tag”, for approval by Consultant and City of Winnipeg. Include copy of approved lamacoid and plastized “luggage tag” list in each Maintenance/Operating Manual.
- .11 Electrical systems identification to be as per electrical specifications.

1.9 CALIBRATION AND ADJUSTMENT OF CONTROLS SYSTEMS

- .1 All components shall be calibrated before the areas are occupied in order to minimize the disruption to the occupants following the takeover the building.
- .2 Upon completion of the installation phase of the project, calibrate and adjust all controls systems and components installed under this contract to provide acceptable space conditions and proper functioning of the systems. Keep a written log of the calibration data for each device, including the instrumentation against which the equipment is calibrated. Include this log in the Operation and Maintenance manuals.
- .3 If requested, the Contractor shall be prepared to provide written documentation of recent calibration checks for all instrumentation and sensors.

1.10 START-UP AND COMMISSIONING

- .1 Provide equipment, personnel and material necessary to put the Control Systems into operation.
- .2 Coordinate and cooperate with all the other Contractors to place the Mechanical Systems into operation to the satisfaction of the City of Winnipeg.

- .3 Provide equipment, personnel, material and information necessary to assist the Mechanical Contractor in completing the Commissioning Process.
- .4 The Contractor and his sub-contractors must assist the Commissioning Agent to the extent required to complete the Commissioning requirements.

1.11 VERIFICATION AND OPTIMIZATION OF THE OPERATION OF THE MECHANICAL SYSTEMS

- .1 The installation shall be completely tested, demonstrating that the equipment and systems installed are performing in the manner intended.
- .2 Provide equipment, personnel and materials necessary to produce written records for verification of the operation of all control systems and all equipment.
- .3 Provide equipment, personnel and materials necessary to adjust the controls systems as part of the overall optimization of the mechanical systems.
- .4 Adjust control set points and tune control algorithm performance to optimize the operation of the systems.
- .5 Provide records consisting of computer generated trending logs, snap shot readings of set points and settings of variables, and any other method capable of demonstrating to the Consultant that the systems are operating optimally.
- .6 At the time of completion, provide trend logs for each and every system to demonstrate the satisfactory operation of each system and each component.
- .7 The Contractor shall provide analysis of the trend log data and shall make any and all changes to the controls systems as required to correct deficiencies or to optimize the operation of the systems.
- .8 Trend logs shall be printed/saved, clearly labeled for time, date, system and variables tracked. Trend log data shall be stored in a file format capable of being imported into a spreadsheet program for graphing.
- .9 The Contractor shall be aware that additional trend logs may be required to be submitted during the warranty period to troubleshoot system deficiencies. Prepare and submit this data as required.

1.12 OPERATION AND MAINTENANCE DATA

- .1 Provide detailed operation and maintenance data.

- .2 The shop drawings shall be enhanced and revised to 'as-built' status, and shall include the following:
 - .1 Details of adjustments of devices and components;
 - .2 All information necessary for the operation, maintenance, parts procurement and replacement for each component of the entire system;
 - .3 Specific part numbers;
 - .4 Complete recommended spare parts inventory list, with lead time and expected frequency of use;
 - .5 Instructions and schedules for inspection, cleaning, lubrication and calibration.
- .3 At the completion of the installation, provide one marked-up copy of the tender drawings for record purposes. Provide three sets of operation and maintenance manuals. Pay all costs associated with the production of the “record” drawings and the manuals. Prior to system acceptance testing, submit the documents to the Consultant for review, and make any requested changes before delivering them to the City of Winnipeg.

1.13 SYSTEM ACCEPTANCE

- .1 Complete the system installation, start-up, calibration and verification prior to acceptance testing by the City of Winnipeg. Submit a letter to the Consultant certifying that the controls have been installed, the software programs have been exercised, and requesting system acceptance. Include all verification data and certificates confirming that the work has been installed to the satisfaction of the authorities having jurisdiction.
- .2 Acceptance testing will commence on a mutually agreeable time within 14 calendar days of request.
- .3 At the time of acceptance testing, turn over to the City of Winnipeg the revised Operation and Maintenance data and a pre-paid Warranty and Service Agreement. The system will not be accepted without complete documentation.
- .4 Provide operating and maintenance personnel, and tools and material, as required to operate and adjust the system(s), and coordinate with the City of Winnipeg and Consultant, to completely test and verify the operation of the system(s). It is expected that this testing will take place during the cooling season. Allow for additional testing and verification at the beginning of the next heating/cooling season.
- .5 When the system has been deemed satisfactory for beneficial use, the warranty period will commence.

1.14 INSTRUCTIONS TO CONTRACT ADMINISTRATOR'S

- .1 Provide the services of qualified personnel to instruct the City of Winnipeg's personnel in the complete operation and maintenance of every aspect of the controls systems, including recalibration of sensors.
- .2 Review the operation and maintenance of the systems with the City of Winnipeg's maintenance personnel and provide written and/or verbal instructions as required.
- .3 Within the scope of the contract, on-site instructions are to be scheduled as follows:
 - .1 For two full working days (total 16 hours) within one month of Final Acceptance. This may be scheduled as two consecutive days, two non-consecutive days, four half days or other as mutually agreeable to suit both parties.
 - .2 Follow up instructions of 3 days during the first year following Final Acceptance. This can be done in conjunction with regularly scheduled maintenance service.
 - .3 One additional day following the next heating/cooling season testing and verification (as applicable).

1.15 WARRANTY/SERVICE AGREEMENT

- .1 Provide a written warranty, signed and issued to the City of Winnipeg, stating that the control systems are warranted against faulty material and/or workmanship for a period of one (1) year from the date of Final Acceptance.
- .2 No certificate issued, payment made, or partial or entire use of the systems by the City of Winnipeg, shall be construed as acceptance of defective work or materials.
- .3 Promptly correct any defects in workmanship or material during the warranty period at no charge to the City of Winnipeg, provided that the failure is not due to improper usage by the City of Winnipeg. Make good all damages incurred as a result of the failure and of the repairs. When correcting defects and maintaining the system, take precautions to minimize disruption to the tenants.
- .4 Provide preventative maintenance at 3 month intervals. Coordinate exact dates and times with the City of Winnipeg, to allow for the maintenance personnel to be present. Maintain a log on site, accessible to authorized personnel, of tasks performed at each visit. The Contract Administrator shall sign the log at the time of the visit as evidence that the Warranty Service Agreement is being maintained.
- .5 Incorporate system hardware and software modifications, operating parameter changes and setpoint changes into the Operating and Maintenance manuals. Save database changes on disk for backup.

- .6 Implement DDC software upgrades on the anniversaries of the start of the warranty period. Provide all the enhancements offered by the software manufacturer(s).
- .7 Use service personnel directly in the employ of the Controls Contractor to perform service work.
- .8 Provide warranty and maintenance service under 'emergency repair' service provisions. Third party service or services only during specific working hours is not acceptable.
- .9 Provide 'on-site' service for the computer hardware and software.

PART 2 Products And Materials

2.1 GENERAL

- .1 The controls system shall be designed, and components selected, so as to be fail-safe, operating to protect the building, the occupants and vulnerable equipment from harm or damage in the event of a failure of the controls system or the power system.
- .2 The control system shall include all necessary and specified control equipment properly installed in accordance with specifications and drawings.
- .3 All equipment and materials shall be new and C.S.A. approved, unless specifically noted otherwise.
- .4 All similar equipment and or materials shall be by the same manufacturer.
- .5 Components and software shall be of the latest available model and version. Replacement parts shall be readily available from local dealers.

2.2 AUXILIARY CONTROL DEVICES & DDC SYSTEM SENSORS

- .1 General:
 - .1 Where specified, shown and/or required, provide system sensors with the following characteristics:
 - .1 Humidity (polymer capacitive type): range: 0-100% RH, accuracy: 3.0%.
 - .2 Temperature (bulb type): range: -50 deg. F to 250 deg. F, accuracy: 0.01%.\
 - .2 Sensors shall be installed in accordance with manufacturer's instructions and shall be located as per the MECB as listed below:

- .1 Between 1400mm and 1500mm above the floor,
- .2 On interior partitions or walls, or on exterior walls where a minimum effective thermal resistance of $3.5 \text{ m}^2 \cdot ^\circ\text{C}/\text{W}$ is provided between the sensor & outdoors,
- .3 Away from direct exposure to sunlight and heat-producing sources, and
- .4 Away from draughts or dead pockets of air.

.3 Refer to PART 4 – Sequence of Operations for Controls below for further information.

.2 Wall Sensors:

- .1 BACnet sensor shall be capable of communicating over a BACnet MS/TP communications network to the building automation system (BAS).
- .2 Standard wall sensor shall use a solid-state sensor.

2.3 IDENTIFICATION OF EQUIPMENT - NAMEPLATES, LABELS AND TAGS

- .1 Use engraved black and white laminated plastic, 25mm x 62mm (1") x (2-1/2"), at all thermostats, thermometers, panels, etc., supplied so as to clearly indicate service of particular device. Manual switches, unless they come with standard nameplates, and thermostats, thermometers, switches, etc., installed on local panels to be similarly labelled.
- .2 Excluding room thermostats and damper assemblies, provide lamacoid identification plates fastened with rivets or self-tapping screws at all equipment supplied by Section 23 09 00 so as to clearly indicate service of particular device. All manual switches, unless they come with standard nameplates, shall be similarly labelled.
- .3 Equipment installed on surfaces of local panels shall be similarly labelled. Equipment mounted inside local panels must have permanent plate labels with self-tapping screws. Tape labels are not acceptable.
- .4 Identification plates, by Section 23 09 00, to be white background with minimum 5mm high black letters, unless specified otherwise. Electrical systems identification to be as per Division 26 00 00.
- .5 Provide tags at all equipment not suited for attaching nameplates. Tags shall be engraved, all metal, attached with metal key chains.
- .6 Nameplates, labels and tags shall include function, setpoint and equipment names and ID numbers.

- .7 Information on lamacoid identification plates to be consistent with "as-built" control drawings.
- .8 Prior to lamacoid fabrication, submit copies of control drawings and complete list of proposed wording for each lamacoid, for approval by Consultant and City of Winnipeg. Include a copy of the approved lamacoid list in each Maintenance/Operating Manual.

2.4 PIPING/TUBING – POWER, INTERLOCKING, & CONTROL WIRING - ACCESSORIES

- .1 Control wiring and conduit shall meet or exceed the requirements of C.S.A., U.L.C., the current edition of the Canadian Electrical Code, and all local Code requirements as well as the requirements as specified in Division 26 00 00.
- .2 Control wiring shall be connected from specific breakers in power panels. Refer to Electrical Drawings.
- .3 The Controls Contractor shall provide piping/tubing and power and control wiring required by the control systems.
- .4 The Controls Contractor shall provide power transformers required by the controls systems.
- .5 The Controls Contractor shall provide all interlock piping/tubing and wiring required by the control systems, including but not limited to electric switches, piping/tubing and wiring between control system components such as low limit protection, thermostats, alarms, motor starters and motor interlocks, etc., as required to achieve the control function specified in the schematic drawings and sequences of operation.
- .6 All control wiring, regardless of voltage, shall be installed in a continuous, dedicated system of rigid metal tubing (EMT). Maximum lengths of 7 feet of flexible metal conduit will be accepted for final connections to devices and equipment.

PART 3 Installation And Execution

3.1 EXAMINATION

- .1 Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.
- .2 Notify the Contract Administrator in writing of conditions detrimental to the proper and timely completion of the work.
- .3 Do not begin work until all unsatisfactory conditions are resolved.

3.2 INSTALLATION (GENERAL)

- .1 Install in accordance with manufacturer's instructions.
- .2 Provide all miscellaneous devices, hardware, software, interconnections, installation, and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

3.3 COMPONENTS - GENERAL

- .1 Mount exposed components for easy access and protect from damage.

3.4 LOCATION AND INSTALLATION OF COMPONENTS

- .1 Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3 feet of clear access space in front of units. Obtain approval on locations from Contract Administrator prior to installation.
- .2 All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture, and high or low temperatures.
- .3 Identify all equipment.

3.5 PIPING/TUBING – POWER, INTERLOCKING, & CONTROL WIRING - ACCESSORIES

- .1 Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 00 00 and all national, provincial and local electrical codes.
- .2 Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.
- .3 Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Contract Administrator prior to rough-in.
- .4 Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings; coordinate with electrical contractor.

- .5 All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements & as per Section 2.15.6 noted above.
- .6 Run piping, tubing and conduit neatly clipped to walls or structural members, parallel to and at right angle to, building lines.

3.6 FIELD SERVICES

- .1 Prepare and start logic control system under provisions of this section.
- .2 Start up and commission systems. Allow sufficient time for startup and commissioning prior to placing control systems in permanent operation.
- .3 Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. City of Winnipeg shall provide phone line for this service for one year or as specified.
- .4 Provide Contract Administrator with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.7 TRAINING

- .1 Provide application Consultant to instruct City of Winnipeg in operation of systems and equipment.
- .2 Provide system operator's training to include (but not be limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide this training to a minimum of three persons.

3.8 PROJECT COMPLETION

- .1 Prior to the Occupancy Stage of each Construction Phase:
 - .1 Start-up and Commission the Controls Equipment and Systems.
 - .2 Assist the Mechanical Contractor in the Start-up and Commissioning of the Mechanical systems.
 - .3 Calibrate all sensors, etc, provided under this contract.
 - .4 Verify and optimize the system.

- .5 Provide three complete instruction manuals, complete with "as constructed" schematics, for insertion into the Operation and Maintenance Manuals.
- .6 Provide instructions to City of Winnipeg as required. Refer to Specification Section 21 05 01.

3.9 CALIBRATION AND ADJUSTMENT OF CONTROLS SYSTEMS

- .1 All components shall be calibrated before the areas are occupied in order to minimize the disruption to the occupants following the takeover the building.
- .2 Upon completion of the installation phase of the project, calibrate and adjust all controls systems and components installed under this contract to provide acceptable space conditions and proper functioning of the systems. Keep a written log of the calibration data for each device, including the instrumentation against which the equipment is calibrated. Include this log in the Operation and Maintenance manuals.
- .3 If requested, the Contractor shall be prepared to provide written documentation of recent calibration checks for all instrumentation and sensors.

3.10 VERIFICATION AND OPTIMIZATION OF THE OPERATION OF THE MECHANICAL SYSTEMS

- .1 The installation shall be completely tested, demonstrating that the equipment and systems installed are performing in the manner intended.
- .2 Provide equipment, personnel and materials necessary to produce written records for verification of the operation of all control systems and all equipment.
- .3 Provide equipment, personnel and materials necessary to adjust the controls systems as part of the overall optimization of the mechanical systems.
- .4 Adjust control setpoints and tune control algorithm performance to optimize the operation of the systems.
- .5 Provide records consisting of computer generated trending logs, snap shot readings of setpoints and settings of variables, and any other method capable of demonstrating to the Consultant that the systems are operating optimally.
- .6 At the time of completion, provide trend logs for each and every system to demonstrate the satisfactory operation of each system and each component.

- .7 The Contractor shall provide analysis of the trend log data and shall make any and all changes to the controls systems as required to correct deficiencies or to optimize the operation of the systems.
- .8 Trend logs shall be printed/saved, clearly labeled for time, date, system and variables tracked. Trend log data shall be stored in a file format capable of being imported into a spreadsheet program for graphing.
- .9 The Contractor shall be aware that additional trend logs may be required to be submitted during the warranty period to troubleshoot system deficiencies. Prepare and submit this data as required.

PART 4 Sequences of Operations for Controls

4.1 CRAWLSPACE HUMIDITY SENSOR & MONITORING

- .1 Provide D.D.C. humidity sensor installed in crawlspace for monitoring of space humidity levels. Approximate location to be as per the mechanical drawings; coordinate final location on site.
- .2 The existing building D.D.C. control system shall monitor the humidity and calculate the dew point temperature in conjunction with the existing crawlspace temperature sensor on a continual basis. These values shall be monitored and made available to the existing DDC system at all times.
- .3 Alarm shall be generated as follows:
 - .1 Sensor failure: sensor reading indicates shorted or disconnected sensor.
 - .2 High space Dew Point Temperature $\geq 55^{\circ}\text{F}$ (12.8°C) (adj.).
 - .1 The control system shall also be able to monitor Relative Humidity (RH), however, this may not be an accurate measure of the ideal humidity levels in regards to the steel beams in the crawlspace relative to the temperature that the crawlspace is being maintained at throughout the year. For the crawlspace winter heating design temperature set-point of 59°F (15°C), an RH of up to 86.9% (adj.) and Dew Point Temperature of up to 55°F (12.8°C) (adj.) would typically be acceptable. During summer conditions, RH levels between 50% and 45% would be typically acceptable at Dry Bulb Temperatures between 75°F (23.9°C) and 78°F (25.6°C) respectively.
 - .3 The final humidity alarm set point shall be coordinated with the mechanical engineer, structural engineer, architect, & the CofW in relation to the humidity levels dictated by the supplier of the existing steel beams within the crawlspace.

- .4 Humidity Monitoring & History:
 - .1 The crawlspace Dew Point Temperature & Relative Humidity (RH) shall be monitored at all times.
 - .2 The existing control system shall monitor and record the high and low Dew Point Temperature & Relative Humidity (RH) readings within the crawlspace. These readings shall be recorded on a daily, month-to-date, and year-to-date basis. The recording criteria and frequency shall be adjustable by the CofW.
- .5 Provide transformers, relays and power and control wiring as required.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the removal and disposal or storage for reinstallation of all hard and soft landscape features within the area of work outlined on the drawings.

1.2 RELATED SECTIONS

- .1 Section 31 22 13 - Rough Grading.

1.3 DEFINITIONS

- .1 Clearing consists of removing all hard and soft surfaces in the construction area including paving, sod, shrub beds, vegetation, and site furnishings.
- .2 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments larger than 300 mm Ø to not less than a specified depth below existing ground surface.

1.4 STORAGE AND PROTECTION

- .1 Remove and store all precast concrete unit pavers that can be salvaged to be relayed after patio regrading has been completed.
- .2 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, and root systems of trees, which are to remain.
 - .1 Repair any damaged items to approval of Landscape Architect.
 - .2 If damaged, replace any trees designated to remain, as directed by Landscape Architect.

Part 2 Products N/A

Part 3 Execution

3.1 PREPARATION

- .1 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.
- .2 Notify utility authorities before starting clearing and grubbing.

3.2 REMOVAL AND STORAGE OF PAVERS

- .1 Carefully remove precast concrete unit pavers taking care not to chip and break units and stockpile on site for re-use as directed by the City of Winnipeg project representative.

3.3 GRUBBING

- .1 Grub out visible rock fragments, foundations, concrete, and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m³.

3.4 DISPOSAL

- .1 Remove all cleared and grubbed materials other than the pavers off site. Recycle materials if possible.

3.5 FINISHED SURFACE

- .1 Leave cleared surfaces in condition suitable for grading operations.

3.6 CLEANING

- .1 Remove all debris, cleared materials and equipment off site. Leave site clean and tidy ready for topsoil stripping and rough grading.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the layout and rough grading of site features as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 Section 31 37 50 - Landscape Drainage Features and Fixtures
- .2 Section 32 10 00 - Clearing and Grubbing
- .3 Section 32 11 23 Aggregate Base Course Top Up & Regrading
- .4 Section 32 91 19 - Topsoil Placement and Finish Grading
- .5 Section 32 92 21 - Sodding

1.3 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 (600 kN-m/m);).
- .2 City of Winnipeg Standard Construction Specifications, current edition:
 - .1 CW 3170 – Earthwork and Grading
 - .2 CW 2030 – Excavation Bedding and Backfill

1.4 EXISTING CONDITIONS

- .1 Known underground and surface utility lines and buried objects as indicated on the drawings. The Contractor shall be responsible for confirming all utilities with utility providers prior to commencing grading operations.
- .2 Report discrepancies to Landscape Architect if they impact proposed work.
- .3 Any damage to utilities during construction is the responsibility of the Contractor and shall be repaired at no cost to The City.

1.5 PROTECTION

- .1 Protect all existing features, benchmarks, pavement, curbs, trees and above / below ground utility lines. If damaged, Contractor to restore to original condition at no cost to The City.
- .2 Maintain access roads and to prevent accumulation of construction related debris on roads.

1.6 TESTING

- .1 The inspection and testing of fill / subgrade compaction will be carried out by a testing laboratory appointed by the Contractor and approved by the Landscape Architect. Testing laboratory to be certified in accordance with CSA A283. The Contractor shall coordinate the timing of this testing in an efficient way.
- .2 The inspection and testing of fill material compaction will be paid for by the Contractor
- .3 Test fill / subgrade at two (2) locations as directed by the Landscape Architect.
- .4 Areas that fail minimum compaction requirements shall be re-compacted and tested by the Contractor at no cost to The City.

Part 2 Products

2.1 MATERIALS

- .1 Fill Material:
 - .1 Common fill: to City of Winnipeg Specification CW 3170 – Earthwork and Grading, subject to approval by Landscape Architect.
 - .2 Fill under landscaped areas: Class 4 backfill to City of Winnipeg Specification CW 2030.

- .2 Shape fill to profiles required to accommodate surface finish and drainage features per the drawings.
- .3 for reshaping and compaction of granular base at patio see section 32 11 23.
- .4 Fill material to be unfrozen and free from rocks larger than 75mm, cinders, ashes, sod, refuse or other deleterious materials.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.

3.2 LAYOUT

- .1 Engage professional surveyor to layout all major site features as indicated on the drawings.
- .2 Stake out key corners, endpoints and centre lines complete with rough grade and finish grade markers.
- .3 Report any discrepancies encountered during layout to the Landscape Architect immediately.
- .4 Obtain approval of layout from Landscape Architect prior to proceeding with rough grading operations.

3.3 ROUGH GRADING AND SHAPING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated on the Drawings using unfrozen fill materials.
- .2 Cut new drainage channel first coordinating work with section 31 37 50 Landscape Drainage Features and Fixtures and associated civil works.
- .3 Inspect sub-grade exposed by clearing and grubbing with Landscape Architect and identify any problem areas (especially oversaturated soil) that will require remediation. Cut out these 'soft areas' of sub-grade not capable of compaction and fill with Class 2 backfill to CW 2030.
- .4 Compact sub-grade to 95% SPMD throughout using bobcat roller equipment and hand operated tampers in tight spaces (especially against the building face).
- .5 Do not place fill over porous, wet, frozen or spongy sub-grade surfaces.
- .6 Place and compact fill material in equal continuous layers in accordance with specification CW 2030. Layers not to exceed 150mm depth.
- .7 Employ a placement method that does not disturb or damage other work. Where areas are too small to be compacted with large machinery use vibratory compaction equipment or hand rollers to achieve required compaction. Obtain Landscape Architect's approval of alternate equipment prior to use.
- .8 Compact existing subgrade and fill areas to the density requirements noted on the Drawings. Maintain optimum moisture content of fill materials to attain required compaction density.

3.4 SURPLUS MATERIAL

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping off site.

3.5 ACCEPTANCE

- .1 Obtain final approval of rough grading via site inspection with Landscape Architect.
- .2 Produce final compaction test results for deficient areas prior to proceeding with hard and soft landscape site development operations.

3.6 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM) – Latest Editions
 - .1 ASTM C117- 03 Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63 2002, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557-02e1, Standard Test Methods 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-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .2 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .3 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .4 City of Winnipeg Standard Construction Standard Specifications (CW)
 - .1 CW 2030 – Excavation, Bedding and Backfill

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 0.50 m³ and which cannot be removed by means of heavy-duty 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, chemically unstable, and compressible materials.
 - .2 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.
 - .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 Unshrinkable 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 SAMPLES

- .1 Submit samples of bedding, backfill and fill materials to be used, prior to beginning Work. Pack tightly in containers to prevent contamination, and inform Consultant of proposed source of materials.

1.4 QUALITY ASSURANCE

- .1 The inspection and testing of soil compaction will be carried out by a testing agency designated and paid for by the Owner. The Contractor shall coordinate the timing of this testing in an efficient way.
- .2 The Owner will pay for the cost of one (1) series of tests only, on the area being evaluated. The Contractor shall pay for costs of additional testing as required due to improper performance of work.

1.5 LAYOUT OF WORK

- .1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.
- .2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.6 EXISTING CONDITIONS

- .1 Examine test hole logs in geotechnical reports available upon request from the Owner.
- .2 Existing buried utilities and structures:
 - .1 Sizes, depths and locations of existing utilities and structures indicated on drawings, are for guidance only. Their completeness and accuracy shall be confirmed on site by the Contactor.
 - .2 Prior to commencing any excavation Work, notify all applicable utility authorities, having jurisdiction, to clearly mark related locations on site and prevent the disturbance of these markers during the Work. Establish the location and state of use of all buried utilities and structures.
 - .3 Confirm the locations of all buried utilities by careful test excavations.
 - .4 Maintain and protect water, sewer, gas, electric, telephone and other utilities and structures encountered, from damage.
 - .5 Where utility lines or structures exist in area of excavation, notify the Consultant before re-routing.
 - .6 Carefully record the location, size, type, and depth of all maintained, re-routed, and abandoned underground lines on the Project Record Set.
 - .7 Confirm the locations of all recent excavations adjacent to area of excavation.
- .3 Existing surface features:
 - .1 Conduct a condition survey of all existing, trees and other plants, lawns, fencing, service poles, wires, pavement, survey benchmarks and monuments, which may be affected by Work of this Contract.
 - .2 Protect existing surface features from damage while Work is in progress. In event of damage, immediately make repairs to the approval of the Consultant.
 - .3 Only where required in the area of excavation, carefully trim roots or branches to the approval of the Consultant.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Backfill material shall consist of either unfrozen clay material excavated from the trench with no lumps or stones exceeding 150mm in diameter, or Type 1 material consisting of well –graded pit run material.
 - .1 Type 1 material 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.

Sieve Designation	% Passing Type 1
75 mm	90-100
28 mm	80-100
20 mm	-

Sieve Designation	% Passing Type 1
10 mm	-
5 mm	40-80
2.5 mm	-
0.630 mm	-
0.315 mm	10-35
0.080 mm	5-30

.2 Bedding material shall consist of clean, dry, unfrozen sand or Type 2/3 material consisting of sound, hard, crushed gravel free from organic or soft material that would disintegrate through decay or weathering and well-graded throughout.

.1 Type 2/3 material 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.

Sieve Designation	% Passing		
	Type 2	Type 3	Sand
75 mm	-	-	-
28 mm	-	100	-
20 mm	100	-	-
10 mm	-	-	100
5 mm	40-70	0-5	90-100
2.5 mm	25-60	-	-
0.630 mm	-	-	25-60
0.315 mm	8-25	-	-
0.080 mm	6-17	-	0-3

Part 3 EXECUTION

3.1 SITE PREPARATION

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

3.2 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Consultant's review details of proposed dewatering or heave prevention methods, including dikes, and well points.
- .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.

3.3 EXCAVATION

- .1 Excavate down to designated lines, grades, elevations and dimensions as indicated and/or native subgrade levels and advise Consultant of any obvious silty and soft areas. Protect the exposed native sub grade from freezing, excessive soil moisture loss or gain, water ponding and excessive wheel loads at all times.
- .2 Excavation must not interfere with adjacent foundations. Pile foundations shall be protected from damage. Excavation to be at least 10 feet from pile foundations unless approved by the Consultant.
- .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, unless otherwise authorized by Consultant in writing, 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 safe distance away from edge of trenches.
- .6 Restrict vehicle operations directly adjacent to open trenches.
- .7 Dispose of surplus and unsuitable excavated material in approved locations.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Notify Consultant when bottom of excavation is reached.
- .10 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.

3.4 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Bedding and surround of underground services shall consist of a 200mm minimum thickness of bedding sand or Type 2/3 material, above and below each pipe.
- .2 Place bedding and surround material in unfrozen condition.

3.5 BACKFILLING

- .1 Class 4 Backfill shall be used for proposed pipes installed in open trenches or coring shafts under proposed landscaped areas.
 - .1 Backfill the excavation with suitable common excavation material in maximum 200 millimetre thick layers to the grade required for backfill in accordance with the Drawings. Compact each layer by mechanical means to a density equivalent to that of the surrounding unexcavated material.
- .2 Class 2 Backfill shall be used for proposed pipes installed in open trenches or coring shafts under existing or proposed pavements and granular surfaces.
 - .1 Backfill the excavation with Type 1 material in maximum 300 millimetre thick layers to underside of the pavement structure in accordance with the Drawings.

Compact each layer with a vibratory compactor to at least 98% Standard Proctor Density.

- .3 Do not proceed with backfilling operations until the Contract Administrator has reviewed and approved installations.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .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. Difference not to exceed 1.0 m.
 - .4 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 Consultant.
 - .2 If approved by Consultant, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Consultant.
- .6 Consolidate and level unshrinkable fill with internal vibrators.

3.6 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance with Waste Management Plan.
- .2 Replace topsoil within boulevard areas as directed by Consultant.
- .3 Reinstate boulevard lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation, in accordance to and applicable local regulations
- .5 Clean and reinstate areas affected by Work as directed by Consultant.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

END OF SECTION

PART 1 - General

1.1 DESCRIPTION

- .1 Section includes landscape drains and drainage channel rock mulch and rock rip rap. For catch pits, underground pipes, and existing catch basin connections see civil.

1.2 RELATED SECTIONS

- .1 Section 31 22 13 - Rough Grading.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - .2 ASTM C131-06, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .4 ASTM D1248-05, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
 - .5 ASTM E11-09e1, Standard Specification for Wire Cloth and Sieves for Testing Purposes.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 American Association of State Highway and Transportation Officials (AASHTO).
 - .1 AASHTO M92-05, Standard Specification for Wire-Cloth Sieves for Testing Purposes.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.
- .2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.
- .3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

1.3 SAMPLES

- .1 Set up stone supply yard field visit for landscape architect to view and approve samples of stone mulch and rock rip rap before ordering product.

1.4 SITE CONDITIONS

- .1 Locate and stake all underground utilities that may interfere with the works.

PART 2 - Products

2.1 MATERIALS

- .1 Landscape drain and drainage pipe daylighting to swale at patio
 - .1 Drain: 227x227mm (9x9") black Polypropelene catch basin with galvanized steel grate NDS 900MTLKIT <https://www.ndspro.com/9-x-9-catch-basin-kit-with-metal-grate.html>
Loading Class C with a flowrate of 66 litres/minute
 - .2 Pipe and Connections: 100mm ø solid black Polypropelene pipe complete with threaded collar for connection to NDS 900MLTKIT.
 - .3 For all other drainage pipes and connectors including French drain pipe - see civil.
- .2 Drainage Stone
 - .1 Stone Mulch (within drainage channel): 12-25mm ø rounded granite riverwashed stone of varied colours as supplied by Reimer Soils or approved equal.
 - .2 Stone Rip-Rap (surrounding drainage channel to direct flow at building rain water leaders): 150-900mm ø rounded granite riverwashed boulders as supplied by Reimer Soils or approved equal.

- .3 Geotextile: Polypropylene 0.3mm needle punched non woven geotextile with 80 lb (N) tensile strength, 50% elongation resistance, 210 lbs CBR puncture, 30lb trapezoid tear threshold, 70% UV resistance, 2.2/swc-1 permittivity, and 150 gpm/ft² water flow as manufactured by Titan Geosynthetics or approved equal. https://titanenviro.com/wp-content/uploads/2021/07/TE-3.1-Civil-Nowoven-geotextile_April2018.pdf

PART 3 - Execution

3.1 INSPECTION

- .1 Ensure rough grades conform to required drainage pattern before commencing with geotextiles, drains and drain pipes. Correct all slopes, unstable areas, areas requiring additional compaction of other unsatisfactory conditions are corrected to approval of Landscape Architect.
- .2 Ensure all associated civil works, landscape drains and drainage pipes have been installed, reviews and approved prior to commencing stone installation.

3.2 INSTALLATION

- .1 Pipe trench and bedding:
 - .1 Cut trenches in subgrade, compact trench bottom. Add bedding sand under french drain pipe only as specified by civil.
 - .2 Shape trench and bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .3 Grade as indicated on the drawings providing continuous positive slope to catch pits, catch basins, or daylight locations without low or high spots.
 - .4 Install non-woven geotextile where indicated on drawings in preparation for pipe and stone.
- .2 Landscape Drain and Pipe
 - .1 Ensure precast concrete paver patio has been regraded, relaid, compacted, and approved by the landscape architect before installing the NDS landscape drain abutting outside edge at patio's lowest point as shown on the drawings.
 - .2 push the drain pipe under the existing shrub bed if possible to minimize finish landscape disruption ensuring a minimum 3% slope to daylight just above the bottom of the existing swale as indicated on the drawings. Trench as specified above if pushing is not possible.
 - .3 Install the landscape drain per manufacturers written specifications ensuring the drain is stable flush and true to the patio with the pipe opening facing towards the existing swale.
 - .4 Install the drain pipe per the manufacturers written specifications ensuring a tight waterproof seal where the drain and pipe meet.
- .3 Stone Mulch and Stone Rip Rap Installation:
 - .1 Obtain approval of geotextile, catch pit, french drain pipe, catch basin tie-in, patio landscape drain and pipe installations from Landscape Architect prior to commencing with stone installations.
 - .2 Install large boulder rip rap first creating the edges for the rain water leader stone mulch overflow channels to the french drain. Place boulders on approved subgrade and geotextile starting with the larger 900mm feature boulders first then filling with the smaller 150-600mm stone to form a stable mass. Obtain approval of rip rap installation from the landscape architect prior to commencing with the smaller stone mulch placement
 - .3 Install stone mulch in the french drain trench in 150mm lifts spreading and tamping stone down to form a stable mass. Place last layer of mulch in 75mm lift raking to finished grades and spreading between the boulder rip rap to completely cover all exposed geotextile surfaces.

3.3 CLEANING

- .1 Remove all debris, surplus material and equipment off site. Leave site clean and tidy ready for topsoil stripping and rough grading.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section includes the reshaping of the granular base for the regraded precast concrete unit paving patio.

1.2 RELATED SECTIONS

- .1 32 10 00 – Clearing and Grubbing
- .2 31 22 13 - Rough Grading
- .3 32 14 13 – Precast Concrete Unit Paving

1.3 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 D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .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.
- .3 City of Winnipeg Specifications
 - .1 CW 3110 Sub Grade, Sub base and Base Course Construction
 - .2 CW 3330 Installation of Interlocking Pavement Stones

1.4 TESTING

- .1 Reshaped and compacted base course will be tested at the contractors expense in four locations of the landscape architect's choosing. Please note at least 50% of test locations will be at the edges of the patio against the existing building or deck face.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and stockpile aggregates in locations that are accessible to construction, but will not damage existing structures or landscape elements designated to remain. Stockpile minimum 50% of total aggregate required prior to beginning operation.

Part 2 Products

2.1 GRANULAR A - BASE MATERIAL:

- .1 Aggregate in accordance with *CW 3100*.

Part 3 Execution

3.1 REGRADING PREPARATION

- .1 Remove, salvage and stockpile interlocking pavers per section 32 10 00
- .2 Remove all bedding and joint sand (can be blown into shrub beds). The use of sand to achieve new patio design grades is not permitted.
- .3 Loosen and scarify all base material for easier manipulation to new grades.

- .4 Remove base where it has become contaminated or soft in any way.
- .5 Clean up, straighten and repair patio edger as necessary after paver removal replacing sections that are too damaged to repair or as instructed by the landscape architect on site.
- .6 Engage a professional surveyor to stake out new design grades marking both finish grade and base course grades on stakes for landscape architect's approval prior to commencing with regrading..

3.2 RE-SHAPING, COMPACTION & TESTING

- .1 Do not place frozen or excessively wet material. Do not place materials when daytime temperatures are below -5° C. Place material on clean, unfrozen surface, free from snow and ice.
- .2 Place granular base materials using methods that do not lead to segregation or degradation as per *City of Winnipeg Standard Construction Specifications*.
- .3 For spreading and shaping material, use spreader boxes having adjustable templates or screens, which will place material in uniform layers of required thickness.
- .4 Redistribute existing granular base to achieve new patio grades and slopes. Add new base material in max 50mm lifts as necessary to achieve new grading.
- .5 Shape to smooth contours, water and compact to 100% SPMD as indicated on the drawings taking special care to compact corners and patio edges. Use hand equipment small enough to get into tight corners as necessary to achieve compaction.
- .6 Finished base surface to be within 5mm of elevation as indicated, but not uniformly high or low.
- .7 Contact Landscape Architect to review granular base when reshaped and compacted, and to select the four testing locations.
- .8 Provide test results to Landscape Architect prior to proceeding with paving re-installation, Re compact as many times as necessary to achieve desired compaction levels.

3.3 SURPLUS MATERIAL

- .1 Recycle surplus material and material back to quarry or processing site.

3.4 CLEANING

- .1 Perform cleaning after aggregate base courses to remove construction and accumulated environmental dirt. Remove surplus materials, excess materials, rubbish, tools and equipment.

3.5 PROTECTION

- .1 Maintain finished base in condition conforming to this section until pavers are re-installed.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section includes instructions for repairing one existing crack in the patio seat wall, and adding regularly spaced control joints with metal skate interrupter stirrups along the wall.

1.2 RELATED SECTIONS

- .1 N/A

1.3 REFERENCES

- .1 N/A

1.4 SUBMITTALS

- .1 Submit samples for:
 - .1 Concrete joint sealant
 - .2 Metal Skate Interrupter Stirrup

1.5 SITE CONDITIONS

- .1 Make a careful examination of the site conditions and investigate all matters relating to the nature of the work to be undertaken, the means of access and egress, the rights and interests which may be interfered with during the construction of the work.
- .2 Report any discrepancies or omissions to the Contract Administrator, who will issue written clarification. Oral interpretations or instructions are not acceptable.

1.6 QUALITY ASSURANCE

- .1 Metal skate interrupter stirrups to be manufactured by local ISO certified metal fabrication and galvanizing shop with over 10 years of experience manufacturing exterior grade site furnishings and features such as State Industries or approved equal.

Part 2 Products

2.1 JOINT SEALANT

- .1 Exterior grade approved to -40°C ‘Sikasil’ 728 Non-Sag ultra low modulus and neutral-cure silicone sealant as supplied by Sika Canada <https://can.sika.com/en/construction/adhesives-sealants/joint-sealants/non-sag/sikasil-728-ns.html> or approved equal.

2.2 SKATEBOARD INTERRUPTOR STIRRUP

- .1 9mm thick steel bar, galvanized finish.

Part 3 Execution

3.1 CRACK REPAIR AND NEW CONTROL JOINTS

- .1 Conduct work when pavers have been removed from the patio for reinstallation if possible.
- .2 Locate crack on site with landscape architect and owner. Using crack location as starting point snap chalk lines for control joints at 1.2m o,c along the entire length of the wall as indicated on the drawings.
- .3 Saw cut a 6mm (1/8”) wide by max 25mm (1”) deep control joints along existing crack and at newly chalked additional locations taking care to avoiding exposing any internal reinforcing.
- .4 Clean all loose material and debris from saw cut with high pressure air nozzle.
- .5 Extend sawcut a minimum of 75mm (3”) below the surrounding finished grades on both sides of the wall.
- .6 Install exterior grade Sikasil-728 silicone sealant per manufacturers written specifications in weather that will stay between +10°C and +25°C for at least 24 hours after installation without any rain. Use edger tool to finish joint as a smooth continuous surface with a slight indentation.
- .7 Allow joints to cure at least 3 days and obtain landscape architects approval of the joints prior to commencing with skateboard interrupters.

3.2 SKATEBOARD INTERRUPTOR STIRRUP

- .1 Field measure existing wall depth to determine exact dimensions of new C-stirrup.
- .2 Cut metal to length and bend to size indicated on the drawings and confirmed by field measurements ensuring a clean 90° angle with rounded corners as indicated on the drawings.
- .3 Clean, debur, and degrease filing all lose edges to a smoot snag free finish.
- .4 Galvanize per ASTM A123-17 and CSA G164-18
- .5 Create one fully finished sample of the skateboard interrupter stirrup complete with deburred edges and galvanized finish for landscape architects review and approval of a dry fit on site prior to proceeding with the fabrication and installation of all units.
- .6 Dry fit C-stirrups on site over control joints as indicate on the drawings. Adjust the angle of stirrup to ensure a snug horizontal and vertical fit that makes full contact with the concrete wall along its entire length of the metal.
- .7 Remove the stirrup and add a zig zag pattern of Skiasil 780to the back of the unit. Carefully slip the stirrup back into place ensuring it is vertical and centred.
- .8 Once in place run a thin bead of Sikasil 780 along each edge of the stirrup where it meets the concrete and use a corner edger tool to create a fully sealed finish.

3.3 ACCEPTANCE & CLEANING

- .1 Control Joints and Skateboard Interrupter Stirrups will be accepted by the landscape architect when they are secure, cured, vertically aligned, and the adjacent concrete is free of any drips and stains.
- .2 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers and leave the site clean and tidy.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Requirements and procedures for installing and reinstalling precast concrete unit pavers.

1.2 RELATED SECTIONS

- .1 Section 31 37 50 - Landscape Drainage Features and Fixtures
.2 Section 32 11 23 - Aggregate Base Course Top Up and Regrading

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
.1 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
.2 ASTM C979-99, Standard Specification for Pigments for Integrally Coloured Concrete.
.2 Canadian Standards Association (CSA International).
.1 CSA A23.1/A23.2-0, Concrete Materials and Methods of Concrete Construction/Method of Test for Concrete.
.2 CSA-A231.2-95, Precast Concrete Pavers.
.3 CSA A283-00, Qualification Code for Concrete Testing Laboratories.

Part 2 Products

2.1 CONCRETE PAVERS

- .1 Re-use existing concrete pavers on site as much as possible and supplement with new product to match if/as necessary.
.1 Techo Bloc Blu 60 Smooth in Greyed Nickel (3 sizes to achieve existing random running bond pattern). <https://www.techo-bloc.com/shop/slabs/blu-60-smooth?parent=94731547-cc22-4385-a895-08d9e2879240> as supplied by Trendsapes or approved equal.
.2 Pigment in concrete pavers: to ASTM C979.

2.2 BEDDING AND JOINT SAND

- .1 Manufactured sand for bedding: hard, durable, crushed stone particles, conforming to the gradation of concrete sand as specified in CAN/CSA A23.1, Section 5.3.2. free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
.1 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 rather than ASTM E11. 0% shall pass the 0.075 mm sieve.

Sieve Designation	% Passing
10 mm	100
5 mm	95 - 100
2.5 mm	80 - 100
1.25 mm	50 - 90
0.630 mm	25 - 60
0.315 mm	10 - 35
0.160 mm	2 - 10

.2 Polymeric Joint Sand: fine, hard, durable, angular particles, complete with binding polymer, free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Colour: charcoal grey. Approved Manufacturer: Techniseal, Sakrete or approved equal.
.3 Edging: High Density Polyethylene Edge restraint, complete with interlocking ends. Colour: Black. Acceptable product: Snap Edge or approved equal. Edge restraint securing spikes: 12mm ø x 305 mm, galvanized.
.4 Fibre Expansion Joint: 12mm thick black Flexcell as supplied by Brock White or approved equal.

2.3 CLEANING COMPOUNDS

- .1 Clear, organic solvent, designed and recommended by manufacturer for cleaning concrete pavers of contamination encountered.

- .2 Acid based chemical detergent, designed and recommended by manufacturer for removal of contamination encountered on pavers.

Part 3 Execution

3.1 PAVER REMOVAL & GRANULAR BASE REGRADING

- .1 Paver removal per section 32 10 00 Clearing and Grubbing.
- .2 Granular base reshaping and regrading per section 32 11 23 Aggregate Base Course Regrading.

3.2 EDGING

- .1 Straighten, reinstall, or install new edging straight flush and true as necessary after regrading granular base course.
- .2 Secure edge restraint with galvanized spikes at 300 mm on centre and at all corners and joints
- .3 Install fibre expansion joint against building and deck face after granular base has been regraded securing with exterior grade spray adhesive to hold in place until pavers are fully laid.

3.3 BEDDING SAND

- .1 Ensure bedding material is not saturated or frozen at all times until installation is complete.
- .2 Place, spread and screed material on structural surface to achieve maximum 15 mm compacted thickness after vibrating pavers in place. Do not use joint sand for bedding sand.
- .3 Do not disturb screeded material. Do not use bedding material to fill depressions in base material.
- .4 Use of joint sand or limestone screenings as bedding material will not be accepted.

3.4 PAVER REINSTALLATION

- .1 Ensure bedding sand and granular base are not saturated prior to placement of unit pavers.
- .2 Clean all salvaged pavers removing all debris and polymeric sand. Mix new and old paver units throughout the reinstallation to prevent distinct colour demarcation between old and new pavers on the patio surface
- .3 Install unit paving true to grade on the bedding sand to previous existing pattern. Compact and level units with min. 22 kN force mechanical plate vibrator use plywood or neoprene pad under plate compactor and over units, until they are true to grade and free of movement.
- .4 Sweep dry, polymeric joint sand material into joints in multiple directions.
- .5 Pass mechanical plate vibrator over unit paving to achieve compaction of sand in joints. Protect pavers from damage during compaction activities. Continue application of joint material and vibrating of pavers until joints are full. Do not vibrate within 1 m of unrestrained edges of pavers.
- .6 Sweep off excess joint material when installation is complete.
- .7 Moisten polymeric joint sand to activate polymer binding agent as per manufacturers instructions.
- .8 At the completion of each workday, ensure all work within 1 m of laying face is left fully compacted with sand filled joints.
- .9 Surface of finished pavement should be free from depressions exceeding 5 mm as measured with 3 m straight edge. Ensure pavers are at least 10mm below exit door thresholds and completely flush and level with adjacent decking when fully compacted. Surface elevation of pavers: 3 to 4 mm above adjacent drainage inlets, concrete collars or channels.

3.5 ACCEPTANCE AND CLEANING

- .1 Surfaces will be approved by the landscape architect only when they are properly graded to drain, flush with adjacent thresholds and table with fully sanded joints.
- .2 Remove and dispose of loose, extraneous materials from surfaces to be cleaned.
- .3 Apply cleaning compounds appropriate for removal of various contaminants encountered in accordance with manufacturer's recommendations. Final surface to be free of contamination.

3.6 CLEAN UP OF SITE

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section covers the supply and installation of planting medium for tree pits and sod.

1.2 RELATED SECTIONS

- .1 Section 32 22 13 - Rough Grading.
- .2 Section 32 92 21 - Sodding
- .3 Section 32 93 10 - Tree Planting

1.3 REFERENCES

- .1 Agriculture and Agri-Food Canada
 - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
 - .1 PN1340-2005, Guidelines for Compost Quality.
- .3 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.4 QUALITY ASSURANCE

- .1 Planting Mix to be from a reputable local supplier such as T&T Soils, Reimer Soils, Gauthier Soils or approved equal.

Part 2 Products

2.1 TOPSOIL

- .1 Topsoil: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
 - .2 Topsoil shall be free of subsoil contamination, roots, stones, or clay lumps over 40 mm in diameter and other extraneous matter. Salinity rating less than 2.5 dS/m and a pH range of 6.5-8.0. Topsoil shall not contain quack grass rhizomes, Canada thistle roots or other noxious weeds.
 - .3 Fertility: major soil nutrients present in following amounts:
 - .1 Nitrogen N: 20 to 40 micrograms of available N per gram of topsoil.
 - .2 Phosphorus P: 40 to 50 micrograms of phosphate per gram of topsoil.
 - .3 Potassium K: 75 to 110 micrograms of potassium per gram of topsoil.
 - .4 Calcium, magnesium, sulphur and micro-nutrients present in balance ratios to support germination and/or establishment of intended vegetation.
 - .4 Topsoil shall not be blown dirt deposited in ditches along wind erosion sites.
 - .5 Topsoil shall not be taken from fields abandoned to corn production where such soil may contain soil-incorporated herbicides with lasting residual effects such as Eradicane and Atrazine.
 - .6 Contain no toxic elements or growth inhibiting materials.
 - .7 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
 - .8 Consistence: friable when moist.

2.2 SOIL AMENDMENTS FOR IMPORTED AND STOCKPILED TOPSPOIL

- .1 Fertilizer: Synthetic slow release starter fertilizer with a N-P-K analysis of 12-36-15 ration at a rate of 4 kg/100 m² (8 lb / 100 ft. 2)
- .2 Peatmoss: Derived from partially decomposed species of Sphagnum Mosses. Elastic and homogeneous, brown in colour. Free of wood and deleterious material which could prohibit growth. Shredded particle minimum size: 5 mm.

- .3 Sand: washed coarse silica sand, medium to course textured.
- .4 Organic matter: compost Category B in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .5 Limestone: Ground agricultural limestone. Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

2.3 PLANTING MATERIAL TYPE, SOURCE, & QUALITY CONTROL

- .1 Planting Mix for Tree Pits and Sod – 4 way mix as supplied by Reimer Soils containing 45% topsoil, 30% peat, 20% sand and 5% compost. or approved equal.
- .2 Contractor is responsible for amendments to the planting medium as specified if necessary.
- .3 Provide planting mix fertility test results from supplier.

Part 3 Execution

3.1 PLANTING MIX

- .1 Planting medium must be well crushed, screened and mixed when it arrives to site.

3.2 PREPARATION OF EXISTING GRADE

- .1 Verify that subgrades are correct. If discrepancies occur, notify Landscape Architect immediately.
- .2 Cultivate entire area which is to receive planting medium to minimum depth of 100 mm. Cross cultivate those areas where equipment used for grading, hauling, and spreading has compacted soil.

3.3 PLACING AND SPREADING OF PLANTING MEDIUM

- .1 Place planting medium after the landscape architect has accepted the regraded subgrade.
- .2 Spread planting medium in uniform layers not exceeding 150 mm.
- .3 For sodded areas keep planting medium 15 mm below finished grade.
- .4 Manually spread planting medium around trees, shrubs and obstacles.

3.4 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Landscape Architect. Leave surfaces smooth, uniform and firm against deep footprinting.

3.5 ACCEPTANCE

- .1 Landscape Architect will inspect and may take final samples to test installed planting medium if mixture does not look, feel or smell like approved mix.
- .2 Should tests deem planting medium does not meet the physical and chemical requirements of this specification the Contractor shall amend mix and pay for additional testing until such time as the planting medium meets the requirements and is accepted by the Landscape Architect.
- .3 Obtain final approval of planting medium placement and finish grading from Landscape Architect prior to installing trees and sod.

3.6 CLEANING

- .1 Dispose of materials except topsoil not required off site.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of sod in regraded areas as indicated on the drawings.

1.2 RELATED SECTIONS

- .1 Section 32 91 19 – Planting Medium and Finished Grading
- .2 Section 32 93 10 – tree Planting

1.3 QUALITY ASSURANCE

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

Part 2 Products

2.1 MATERIALS

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop as supplied by Lach Sod Farms or approved equal. Mineral sod only no peat sod.
 - .1 Turf Grass Nursery Sod types:
 - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 100% Kentucky Bluegrass cultivars with a minimum of three (3) number one named Kentucky Bluegrass cultivars.
 - .2 Turf Grass Nursery Sod quality:
 - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square meters.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50mm.
 - .3 Mowing height limit: 35 to 65mm.
 - .4 Soil portion of sod: 6 to 15mm in thickness.
 - .3 Water: potable
 - .4 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete, synthetic, slow release with 65% of nitrogen content in water-insoluble form.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from Landscape Architect of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from Landscape Architect.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with section 32 91 19. If discrepancies occur, notify Landscape Architect and do not sodding again until instructed by Landscape Architect.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, per section 32 91 19.
- .4 Remove and dispose of weeds; debris; stones 50mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site in location as directed by Landscape Architect.

3.2 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted if air temperature exceeds +20° C.
- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod with 90 kg roller.

3.3 ESTABLISHMENT PERIOD

- .1 Perform the following operations from time of installation until thirty (30) days following the issuance of Certificate of Substantial Completion.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100mm.
- .3 Cut grass to 50mm when or prior to it reaching height of 75mm. Remove clippings which will smother sodded areas.
- .4 Maintain sodded areas so they are 95% weed free.

3.4 ACCEPTANCE

- .1 Turf Grass Nursery Sod areas will be accepted by the Landscape Architect provided that:
 - .1 Sod has clearly rooted into the planting medium below and growing vigorously.
 - .2 Sod is free of bare and dead spots with no surface soil visible from height of 1500mm after grass has been cut to 50mm ht.
 - .3 Sodded areas have been cut a minimum two (2) times.
- .2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.5 CLEANING

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section covers the supply and installation of new trees.

1.2 RELATED SECTIONS

- .1 Section 31 22 13 - Rough Grading.
- .2 Section 32 91 19 - Topsoil Placement and Finish Grading.

1.3 REFERENCES

- .1 Agriculture and Agri-Food Canada (AAFC).
 - .1 Plant Hardiness Zones in Canada-2000.
- .2 Canadian Nursery Landscape Association (CNLA).
 - .1 Canadian Standards for Nursery Stock-2006, 8th Edition

1.4 QUALITY ASSURANCE

- .1 Obtain approval or plant material at source.
- .2 Notify Landscape Architect of source of material at least seven (7) days in advance of shipment. No work under this Section is to proceed without approval. Acceptance of plant material at source does not prevent rejection on site prior to or after planting operations.
- .3 No important plant material will be accepted for this project.

1.5 STORAGE AND PROTECTION

- .1 Protect plant material from frost, excessive heat, wind and sun during delivery.
- .2 Immediately store and protect plant material which will not be installed within 4 hours after arrival at site in storage location approved by Landscape Architect.
- .3 Protect plant material from damage during transportation:
 - .1 When delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
 - .2 When delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical. Protect foliage and root balls using tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.
- .4 Protect stored plant material from frost, wind and sun and as follows:
 - .1 For pots and containers, maintain moisture level in containers.
 - .2 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

1.6 SCHEDULING

- .1 Obtain approval of species alternatives prior to ordering plant material.
- .2 Order plant material as soon as possible after award of Contract to ensure plant availability.
- .3 Obtain approval from Landscape Architect of schedule 14 days in advance of shipment of plant material.

1.7 WARRANTY

- .1 The Contractor shall warrant that plant material as itemized on plant list will remain free of defects in accordance with General Conditions, for twelve (12) months, after the date of Substantial Performance, providing adequate maintenance has been provided.

Part 2 Products

2.1 PLANT MATERIAL

- .1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock. Source of plant material: grown in Zone 2b in accordance with Plant Hardiness Zones in Canada.
- .2 Tree species, cultivar and size as specified on the drawings. Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.
- .3 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.

2.2 PLANTING MEDIUM MIX

- .1 Planting soil mix: as specified in Section 32 91 19 – Topsoil Placement and Finish Grading.

2.3 PLANTING ACCESSORIES

- .1 Fertilizer: Free of impurities that would inhibit plant growth.
- .2 Wooden Stakes: 76mm (3") dia. x 2.4m (8').
- .3 Wire tightener: PG wire tightener.
- .4 Guy Wire: 9 gauge, flexible, non-corrosive stand wire.
- .5 Clamps: U-bolt: galvanized, 12 mm diameter, c/w curved retaining bar and hex nuts.
- .6 Trunk Collars: 100mm ø nylon reinforced, cut on site.
- .7 Guy Collars: Plastic, 12mm diameter, nylon reinforced garden house over guy wire.

2.4 MULCH

- .1 Wood chip: varying in size from 50 mm to 75 mm and 6 mm to 16 mm thick, free of bark, small branches and leaves.

2.5 FERTILIZER

- .1 Synthetic commercial type as per Section 32 92 19 – Topsoil Placement and Finish Grading.
- .2 Horticultural bonemeal; raw bonemeal, finely ground with minimum analysis of 3% nitrogen and 10% phosphoric acid.

Part 3 Execution

3.1 PLANTING

- .1 Obtain approval of site grading prior to commencing tree installations.
- .2 Complete tree installations prior to sodding.
- .3 Obtain approval of trees delivered to site prior to commencing tree installations.
- .4 Layout tree locations on site for landscape architect's approval. and tree planting holes and beds prior to commencing work in this section.
- .5 Excavate tree pit to depth and width as indicated. Remove rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material. Scarify sides of planting hole.
- .6 Remove water which enters excavations prior to planting. Notify Landscape Architect if water source is ground water.
- .7 Remove jute, wire and burlap from root balls without damaging root ball prior to placing in planting pit.
- .8 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads and walks.
- .9 Backfill soil in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated backfill to finish grade.
- .10 Form watering saucer as indicated then water thoroughly to fully saturate soil for an area the minimum of double the width of the rootball.
- .11 Dispose of burlap, wire and container material off site.
- .12 Install trunk protection and two tree supports per tree as indicated on the drawings.
- .13 Ensure soil settlement has been corrected prior to mulching with wood chip mulch.
- .14 Obtain approval of planting before mulching material is applied.
- .15 Spread mulch to minimum thickness of 75 mm ensuring watering saucer is maintained. Moisten mulch with water before installing to prevent it from blowing away.

3.2 WARRANTY PERIOD

- .1 All plantings under this section of work will be inspected by the Landscape Architect immediately after thirty (30) day establishment period.
- .2 A Certificate of Total Performance will be issued at the end of the inspection and the completion of associated replacements / adjustments.
- .3 The date of total performance will mark the beginning of the one (1) year warranty period.
- .4 A plant warranty inspection scheduled and led by the Landscape Architect will be conducted as close to one year after the issuance of the certificate of total performance as possible.

3.3 CLEANING

- .1 Clean the site once planting operations are complete removing all excess planting medium, mulch, fertilizer, containers and planting accessories.
- .2 Fix finished grading where tree planting operations have disturbed the site in preparation for sodding.

3.4 ACCEPTANCE

- .1 Trees, will be inspected at substantial performance and at the end of the one (1) year warranty period. Trees will be accepted by the Landscape Architect, provided that they are showing vigorous well rounded new growth, they are free of disease and pests and they exhibit no signs of malnutrition or stress.
- .2 After the warranty inspection the Contractor shall replace trees that do not meet the standards in 3.11.1 with new plant material as originally specified at no additional cost to The City. All replacement plants shall be subject to a thirty (30) day establishment maintenance period.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 31 23 10 – Excavating, Trenching and Backfilling
- .2 Section 33 41 00 – Storm Utility Drainage Piping.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM) – Latest Editions
 - .1 ASTM A48/A48M-00, Standard Specification for Gray Iron Castings.
 - .2 ASTM C117-04, Standard Test Method for Materials Finer than 75- μm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM C139-05, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .5 ASTM C478M-06, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
 - .6 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³(600 kN-m/m³).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .3 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .4 CSA-A3002-03, Masonry and Mortar Cement.
- .4 City of Winnipeg Standard Construction Standard Specifications (CW)
 - .1 CW 2130 – Gravity Sewers
 - .2 CW 2140 – Sewer and Manhole Cleaning
 - .3 CW 2160 – Concrete Underground Structures and Works

1.3 LAYOUT OF WORK

- .1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.
- .2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Precast concrete sections: to CSA A257.4 and ASTM Standard C 76 Class II and C 478 (circular sections).
 - .1 Catch basins/pits shall be standard pre-cast concrete, with 900mm base diameter and height as shown on the Drawings, followed by a reducer on top.
- .2 Internal joints shall be made watertight using preformed bituminous gaskets or flexible rubber joint sealant.
- .3 Ladder rungs: in accordance with Approved Products for Underground Use in the City of Winnipeg
- .4 Adjusting rings: to CAN/CSA A257.4 and ASTM C478M.
- .5 Cast iron frame and covers: in accordance with Approved Products for Underground Use in the City of Winnipeg
- .6 Cast-in-place concrete, grout, mortar and cement stabilized fill: in accordance with CW 2160 – Concrete Underground Structures and Works.
- .7 Granular bedding and backfill: in accordance with Section 31 23 10 – Excavation, Trenching and Backfilling.

Part 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling and as indicated.
- .2 Obtain approval of Contract Administrator before installing manholes or catch basins.

3.2 INSTALLATION

- .1 Construct catch basins/pits in accordance with details shown on the Drawings, plumb and true to alignment and grade.
- .2 Level bedding to ensure manhole base and catch basin is uniformly supported and the floor is level.
- .3 Install approved gasket or joint sealer between pre-cast concrete sections including 750 millimetre diameter riser adjusting rings and between frame and pre-cast concrete riser as construction progresses.
- .4 Complete units as pipe laying progresses. Connect sewers to manhole bases and catch basins at invert elevations shown on the Drawings and grout in place to make a watertight connection. Coat outside of PVC pipe end for a length equal to the manhole and catch basin/pit wall thickness plus 150 millimetres with an approved cementing agent to which sand has been added and allow mixture to harden before grouting in place. Alternatively

PVC pipe may be connected using an approved pre-treated, gasketed PVC insert or an approved interference fit flexible rubber boot or gasket inserted into a hole cored in the manhole base or catch basin.

- .5 Bench and channel catch pit floor with mortar or concrete. Curve flow channels smoothly and provide smooth transition between inlet and outlet pipes.
- .6 Grout and plug lifting holes, joints and frame to make watertight. Remove excess mortar from inside surface of manhole.
- .7 Set frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.
- .8 Clean units of debris and foreign materials.
 - .1 Remove fins and sharp projections.
 - .2 Prevent debris from entering system.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for storm sewer.

1.2 RELATED SECTIONS

- .1 Section 31 23 10 - Excavating, Trenching and Backfilling.
- .2 Section 33 05 13 – Manholes and Catch Basin Structures

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM) – Latest Edition
 - .1 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft⁴-lbf/ft³ (600 kN-m/m³).
 - .2 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .3 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
 - .2 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).
 - .3 CSA B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
- .3 City of Winnipeg Standard Construction Standard Specifications (CW)
 - .1 CW 2130 – Gravity Sewers
 - .2 CW 2140 – Sewer and Manhole Cleaning
 - .3 CW 2145 – Sewer and Manhole Inspection.
 - .4 CW 2160 – Concrete Underground Structures and Works

1.4 LAYOUT OF WORK

- .1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.
- .2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.5 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services and maintain existing land drainage flows during construction.

- .2 Coordinate storm sewer installation with Mechanical Sub-Contractor's utility installations.
- .3 Submit schedule of expected interruptions to City of Winnipeg for approval and adhere to interruption schedule as approved by Consultant.
- .4 Notify City of Winnipeg, Consultant and neighbouring businesses, a minimum of 48 hours in advance of interruption in service.
- .5 Advise local police department of anticipated interference with movement of traffic.

Part 2 PRODUCTS

2.1 PIPE

- .1 Building service pipe shall be Polyvinyl Chloride Pipe (PVC): SDR 35 in accordance with CAN/CSA B182.2, ASTM D3034, and Approved Products for Underground Use in the City of Winnipeg.
- .2 Pipe joints shall be bell and spigot push on type with rubber gaskets in accordance with ASTM F477
- .3 Trench drain pipe shall be 200 millimetre diameter gasketed bell and spigot High Density Polyethylene (HDPE) Type SP pipe with Class 2 perforations in accordance with AASHTO M252-07. All perforations shall be slotted with a minimum water inlet area of 30 square centimetres per meter of pipe. Drainage pipe shall have a minimum stiffness of 320kPa at 5 percent deflection.

2.2 FITTINGS

- .1 PVC Sewer fittings shall be PVC injection moulded fittings in accordance with ASTM D3034, SDR 35, and Approved Products for Underground Use in the City of Winnipeg.

2.3 CAST-IN-PLACE CONCRETE AND GROUT

- .1 Cast-in-place concrete, grout, mortar and cement stabilized fill: in accordance with CW 2160 – Concrete Underground Structures and Works.

2.4 BEDDING AND BACKFILL MATERIAL

- .1 Bedding and backfill: in accordance with Section 31 23 10 – Excavation, Trenching and Backfilling.

Part 3 EXECUTION

3.1 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 10 – Excavation, Trenching and Backfill

3.2 BEDDING

- .1 Place and compact sand bedding material in the bottom of the excavation in accordance with Section 31 23 10 – Excavation, Trenching and Backfill, to the grade and elevation shown on the Drawings.
- .2 Level across full width of excavation and leave ready for pipe installation.
- .3 Do not place material in frozen condition.

3.3 PIPE INSTALLATION

- .1 Pipe Installation in a trench or using trenchless methods: to CW 2130 – Gravity Sewers
- .2 Handle and join pipes to manufacturer's standard instructions and specifications. Lay pipe with bell upgrade.
- .3 Make watertight connections to manholes and catch basins, in accordance to Section 33 05 13 – Manholes and Catch Basin Structures
- .4 Backfill remainder of trench in accordance with Section 31 23 10 – Excavation, Trenching and Backfill.

3.4 SERVICE CONNECTIONS

- .1 Connection to existing sewer shall be done in accordance to CW 2130 – Gravity Sewers.
- .2 Expose existing watermains, sewers, and other utilities at proposed connection or crossing locations as directed by the Consultant, far enough in advance of sewer installation to allow existing inverts to be determined. The Consultant will modify design grades as required if there is a conflict.

3.5 CLEANING

- .1 Proceed in accordance with CW 2140 – Sewer and Manhole Cleaning
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.6 SURFACE RESTORATION

- .1 After installing and backfilling over storm sewer mains, restore surface to original condition as directed by Consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C88/C88M-18, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - .2 ASTM C131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .4 ASTM D1248-16, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
 - .5 ASTM E11-17, Standard Specification for Wire Cloth and Sieves for Testing Purposes.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 American Association of State Highway and Transportation Officials (AASHTO).
 - .1 AASHTO M92-05, Standard Specification for Wire-Cloth Sieves for Testing Purposes.

1.2 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.
- .2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.
- .3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.
- .4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products
 - .1 Cleanout Covers.
 - .1 Jay R Smith 4250S for exterior areas, surfaced and unsurfaced.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.
- .3 Supply all products from single manufacturer.

2.2 MATERIALS

- .1 Perforated Pipe: to ASTM D1248, 100 mm diameter corrugated high density polyethylene tubing for subdrainage applications with fittings and clean-outs with solid cap. Provide geotextile sock filter for perforated pipe sections.

- .2 Filter Aggregate.
 - .1 Drainage material to consist of clean natural gravel, crushed stone or other materials of similar characteristics having hard, strong, durable, uncoated particles free from injurious amounts of soft, friable, thin, elongated or laminated pieces, alkali, organic or other deleterious matter graded within the following limits:

Canadian Metric Sieve Series (CAN/CGSB 8.2)	Sieves Sizes (AASHTO; ASTM E11)	Percentage Of Total Dry Weight Passing Each Sieve
40,000	37.5 mm	100%
25,000	25.0 mm	50% - 80%
20,000	19.0 mm	5% - 20%
12,500	12.5 mm	0% - 5%
80	0.075 mm	0% - 3%

- .2 Drainage material when subjected to 5 cycles of the soundness test to have a weighted loss of not more than 13% in accordance with ASTM C88/C88M.
- .3 Drainage material when subjected to the abrasion test will have a loss of not more than 30% when tested in accordance with ASTM C131, Grading A.
- .3 Cleanout Cover.
 - .1 Round flanged housing with heavy duty cast iron cover. Provide high flanged and/or low flanged cover to suit surface conditions for each location.

Part 3 Execution

3.1 INSPECTION

- .1 Ensure subgrade conforms with required drainage pattern before placing bedding material.
- .2 Ensure improper slopes, unstable areas, areas requiring additional compaction of other unsatisfactory conditions are corrected to approval of Consultant. Do not begin installation of foundation drainage until deficiencies have been corrected.
- .3 Ensure foundation grade beam damp proofing has been installed and approved by Consultant before placing bedding material.

3.2 INSTALLATION

- .1 Pipe Bedding Preparation.
 - .1 Cut trenches in subgrade and place bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated. Excavation must not interfere with the normal 45 degree bearing splay of foundations.
 - .2 Remove boulders, old construction rubble, and other obstructions encountered in course of excavation.
 - .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .4 Shape transverse depressions, as required, to suit joints.
 - .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.
- .2 Pipe Laying.
 - .1 Install foundation drainage piping in accordance with ASTM D2321 and manufacturer’s printed instructions.

- .2 Ensure pipe interior and coupling surfaces are clean before laying. Connect pipes using manufacturer's recommended fittings.
 - .3 Lay perforated pipe to minimum slope of 1:100. Place pipe face perforations and coupling slots downward.
 - .4 Lay non-perforated pipe to slope of 1:50 from perforated pipe to disposal area. Make joints watertight.
 - .5 Grade bedding to establish pipe slope. Do not use concrete, masonry, stones, wood, or any type of shim to establish pipe slope.
 - .6 Install end plugs at ends of collector piping to protect pipe ends from damage and ingress of foreign material.
 - .7 Connect non-perforated pipe to sump pit by appropriate adapters manufactured for this purpose.
 - .8 Provide cleanouts on non-perforated pipes as indicated, at changes of pipe direction and in runs greater than 15 m.
 - .9 Extend cleanouts up above floor of crawlspace min. 500 mm.
- .3 Pipe Surround Material.
- .1 Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipe as indicated.
 - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not drop material within 300 mm of pipe to prevent displacement of pipe.
 - .3 Place layers uniformly and simultaneously on each side of pipe.
 - .4 Compact each layer from pipe invert to mid-height of pipe to at least 95% maximum density to ASTM D698.
 - .5 Compact each layer from mid-height of pipe to underside of backfill to at least 90% maximum density to ASTM D698.
- .4 Cleanout Cover.
- .1 Install cleanout covers at exterior locations indicated to provide access to weeping tile.
- .5 Backfill Material.
- .1 Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
 - .2 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698. In other areas, compact to at least 90% maximum density to ASTM D698.

END OF SECTION