

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific Project will be returned without being examined and considered rejected.
- .4 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .5 Verify field measurements and affected adjacent Work is co-ordinated.
- .6 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .7 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .8 Keep one (1) reviewed copy of each submission on Site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit one (1) electronic copy of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.
- .2 Submit one (1) electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.
- .3 Submit one (1) electronic copy of test reports for requirements requested in specification Sections and as requested by Contract Administrator.
 - .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.

- .4 Submit one (1) electronic copy of certificates for requirements requested in Specification Sections and as requested by Contract Administrator.
 - .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.
- .5 Submit one (1) electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Contract Administrator.
 - .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.
- .6 Submit one (1) electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .7 Submit one (1) electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.
- .8 Delete information not applicable to Project.
- .9 Supplement standard information to provide details applicable to Project.
- .10 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop Drawings are rejected, noted copy will be returned and resubmission of corrected shop, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .11 Contractor will be charged for Contract Administrator subsequent reviews of submittal packages exceeding two submissions.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Contract Administrator's business address.
- .3 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.

- .5 Adjustments made on samples by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .6 Make changes in samples which Contract Administrator may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

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

1.5 PROGRESS PHOTOGRAPHS

- .1 Submit progress photographs.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 INDEPENDENT INSPECTION AGENCIES

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

1.2 ACCESS TO WORK

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

1.3 PROCEDURES

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

1.4 REPORTS

- .1 Submit four (4) copies of inspection and test reports to Contract Administrator.
- .2 Provide copies to Subcontractor of Work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.5 TESTS AND MIX DESIGNS

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

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.2 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute Work expeditiously.
- .2 Remove from Site all such Work after use.

1.3 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .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; and,
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum ten (10) degrees C in areas where construction is in progress.
- .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases 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; and,
 - .6 Continue operation of ventilation and exhaust system for time after cessation of Work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building may be used when available. Be responsible for damage to heating system if use is permitted.
- .7 On completion of Work for which permanent heating system is used, replace filters.

- .8 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Contract Administrator.
- .9 Pay costs for maintaining temporary heat, when using permanent heating system. The City will pay utility charges when temporary heat source is existing building equipment.
- .10 Maintain strict supervision of operation 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; and,
 - .5 Vent direct-fired combustion units to outside.
- .11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.4 TEMPORARY POWER AND LIGHT

- .1 Provide construction power and light panel board. Provide circuit breaker and cabling and connect to empty circuit in panel board with spare capacity.
- .2 Provide and maintain temporary lighting throughout Project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

1.5 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary telephone fax data hook up, lines, equipment necessary for own use.

1.6 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.
- .2 Burning rubbish and construction waste materials is not permitted on Site.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-S269.2-[M1987(R2003)], Access Scaffolding for Construction Purposes.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Indicate use of supplemental or other staging area.
- .3 Provide construction facilities in order to execute Work expeditiously.
- .4 Remove from Site all such Work after use.

1.4 HOISTING

- .1 Provide, operate and maintain hoists, cranes required for moving of workers, materials and equipment.
- .2 Hoists, cranes to be operated by qualified operator.

1.5 SITE STORAGE/LOADING

- .1 Confine Work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.6 CONSTRUCTION PARKING

- .1 Parking will be permitted on Site in public parking areas provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to Project Site including fire route access.

1.7 SECURITY

- .1 Provide and pay for responsible security personnel to guard Site and contents of Site after working hours and during holidays.

1.8 OFFICES

- .1 Provide office heated to twenty-two (22) degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate Site meetings and furnished with Drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on Site in manner to cause least interference with Work activities.

1.10 SANITARY FACILITIES

- .1 Provide sanitary facilities for Work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.11 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Contract Administrator.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from Site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary.
- .8 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .9 Dust control: adequate to ensure safe operation at all times.

- .10 Provide snow removal during period of Work.

1.12 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from Work Site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

1.13 FIRE ACCESS

- .1 Maintain safe access for fire and rescue vehicles along south side of building.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from Site all such Work after use.

1.2 HOARDING

- .1 Erect temporary Site enclosures.
- .2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.3 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs,
- .2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.5 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such Work is complete.

1.6 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.7 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.8 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Contract Administrator locations and installation schedule three (3) days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of the City or separate Contractor.
- .3 Include in request:
 - .1 Identification of Project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of the City or separate Contractor.
 - .7 Written permission of affected separate Contractor.
 - .8 Date and time Work will be executed.

1.2 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.3 PREPARATION

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

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Remove samples of installed Work for testing.
- .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry Work without prior approval.
- .10 Restore Work with new products in accordance with requirements of Contract Documents.
- .11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material with approved fire stopping assembly.
- .13 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
- .2 Remove waste materials from Site at daily regularly scheduled times or dispose of as directed by Contract Administrator. Do not burn waste materials on Site.
- .3 Clear snow and ice from access to building, bank/pile snow in designated areas only and remove from Site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-Site containers for collection of waste materials and debris.
- .6 Dispose of waste materials and debris off Site.
- .7 Clean interior areas prior to start of finishing Work and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Copy will be returned after final inspection, with Contract Administrator's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two (2) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, four (4) final copies of operating and maintenance manuals in English.
- .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 Furnish evidence, if requested, for 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.

1.2 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of Project and identify subject matter of contents.
- .5 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger Drawings to size of text pages.

1.3 CONTENTS - EACH VOLUME

- .1 Table of Contents:
 - .1 Provide title of project;
 - .2 Date of submission;
 - .3 Names, addresses and telephone numbers of Contract Administrator and Contractor with name of responsible parties.
 - .4 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to 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.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training

1.4 AS-BUILTS AND SAMPLES

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

1.5 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of Drawings.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and Shop Drawings mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum;
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements;
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction;
 - .4 Field changes of dimension and detail;
 - .5 Changes made by change orders;
 - .6 Details not on original Contract Drawings; and,
 - .7 References to related Shop Drawings and modifications.
- .5 Specifications; 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; and,
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents; maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.6 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, Assembly Drawings and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .12 Additional requirements: as specified in individual specification sections.

1.7 MATERIALS AND FINISHES

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

1.8 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to Site; place and store.
- .4 Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.9 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to Site; place and store.

- .4 Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual Specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to Site; place and store. Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

1.11 STORAGE, HANDLING AND PROTECTION

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

1.12 WARRANTIES

- .1 Assemble approved information in binder and submit upon acceptance of Work. 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, executed in duplicate by Subcontractors, suppliers, and manufacturers, within ten (10) 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; and,
 - .6 Retain warranties until time specified for submittal.
- .2 Except for items put into use with City's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .3 Conduct joint eleven (11) month warranty inspection, measured from Date of Substantial Performance, by Contract Administrator.

- .4 Respond in a timely manner to oral or written notification of required construction warranty repair Work.
- .5 Written verification will follow oral instructions. Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Demonstrate operation and maintenance of equipment and systems to City's personnel one week prior to date of substantial performance.
- .2 The City will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

1.2 QUALITY CONTROL

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

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for Contract Administrator approval. Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation.
- .2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

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

1.6 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.
- .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

- .3 Review contents of manual in detail to explain aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

- .1 Ensure amount of time required for instruction of each item of equipment or system is adequate as determined by the Contract Administrator.
- .2 At a minimum allow for training of each system to two (2) separate groups of City personnel.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA S350, Code of Practice for Safety in Demolition of Structures.

1.2 EXISTING CONDITIONS

- .1 Structures to be demolished to be based on their condition on date that tender is accepted.
- .2 Items to be salvaged, as identified by City and/or City's Representative, to be carefully removed protected and handed to City and/or City's Representative.

1.3 DEMOLITION DRAWINGS

- .1 Where required by authorities having jurisdiction, submit for approval Drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
- .2 Temporary supporting structures and shoring systems are to be designed and submittals sealed by a structural Engineer licensed to practice in the province of Manitoba.

1.4 PROTECTION

- .1 Prevent movement, settlement or damage of adjacent structures, services, parts of existing building to remain. Provide bracing, shoring and underpinning as required. Make good damage caused by demolition.
- .2 Take precautions to support affected structures and, if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify the Department Representative or designate.
- .3 Prevent physical intrusion and damage caused by environmental factors such as wind and rain and the spread of dust and contaminants by means of temporary plywood enclosures, screens, fencing, tarps and other means sealed against other areas of the building as required.

Part 2 Execution

2.1 PREPARATION

- .1 Disconnect and re-route electrical and telephone service lines entering areas to be demolished in accordance with authorities having jurisdiction. Post warning signs on electrical lines and equipment which must remain energized to serve other areas of the building during period of demolition.
- .2 Disconnect and cap designated mechanical services in accordance with authorities having jurisdiction where indicated.

- .3 Do not disrupt active or energized utilities designated to remain undisturbed.

2.2 DEMOLITION

- .1 Demolish and remove in general portions of exterior and interior walls, roofing, ceilings, structures, finishes, fixed furnishings and mechanical and electrical components in the area of work that are not to be incorporated in the completed Project.
- .2 At end of each day's Work, leave work in safe condition so that no part is in danger of toppling or falling. Protect interiors of parts to be demolished from exterior elements at all times.
- .3 Demolish to minimize dusting.
- .4 Do not sell or burn materials on Site.
- .5 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

2.3 SALVAGE

- .1 Items to be salvaged: As directed by Department Representative or designate.
- .2 Carefully dismantle items containing materials for salvage and stockpile salvaged materials on Site.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 General Conditions and Division 1 General Requirements govern Work of this Section.
- .2 All Drawings, all Specification sections apply to, and form an integral part of this Section.

1.2 REQUIREMENTS INCLUDED

- .1 Provide all labour, materials, methods, equipment and accessories to complete waterproofing Work, including but not necessarily limited to following:
 - .1 Membrane waterproofing;
 - .2 Surface conditioner;
 - .3 Reinforcing membranes, sealants;
 - .4 Protection board, film;
 - .5 Damp proofing;
 - .6 Connect to, co-operate with Other Contractors waterproofing systems installation, materials; and,
 - .7 Sheet membrane waterproofing to temporary construction, similar.

1.3 SAMPLES

- .1 Submit samples if any, all materials requested, prepaid to Contract Administrator office.

1.4 MATERIAL DELIVERY, STORAGE, HANDLING

- .1 Deliver waterproofing materials in manufacturer original, unopened packaging, seals intact.
- .2 Protect materials; keep under cover in transit, at job site. Handle to prevent damage. Remove from delivery vehicles, place in stacking areas. Ensure materials not dropped or throw.
- .3 Stack materials minimum 300 mm off ground on supports, away from deleterious moisture, weather conditions. Protect with waterproof covers, allow free ventilation.
- .4 Assume responsibility for damage to waterproofing materials, caused by adverse conditions. Discard, replace damaged materials.
- .5 Remove only quantities required for same day use.

1.5 PROTECTION

- .1 Provide covering to adjacent walls, surfaces not receiving waterproofing where materials hoisted, used. Protect buildings from smoke and fumes.
- .2 Provide warning signs and barriers. Maintain in good order until completion.
- .3 Clean off drips, smears waterproofing material.
- .4 Prevent traffic over completed areas except required by Work.
- .5 Comply with precautions deemed necessary by Contract Administrator. Repair damage caused by non-compliance.
- .6 Protect completed work, materials out of storage, at end of each day's Work, when stoppage occurs due to inclement weather.

1.6 ENVIRONMENT

- .1 Exercise caution for proper adhesion, curing when ambient temperatures below four (4) degrees C.
- .2 Do not proceed when temperature consistently below eighteen (18) degrees C, when wind chill effect would set bitumen before proper adhesion.
- .3 Apply damp proofing at minimum ambient temperature four (4) degrees C, rising.
- .4 Use only dry materials; apply only during weather that will not introduce moisture into waterproofing system.
- .5 Protect Work, materials from snow, rain.
- .6 Undertake only Work to be completed same day, prior to precipitation.
- .7 Continue work in adverse weather with suitably heated enclosures, when approved by Contract Administrator.
- .8 Provide forced air circulation during curing periods for enclosed applications.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Membrane Waterproofing: to CGSB 37-GP50M.
 - .1 Surface conditioner: cutback asphalt to CGSB 37-GP-9M.
 - .2 Hot applied modified rubberized asphalt membrane, Hydrotech Membrane Corp. manufacture, membrane 6125.
 - .3 Reinforcing fabric: polyester fabric, Reemay Style 2016.
 - .4 Standard elastomeric reinforcing membrane: to manufacturer standard, width 900 mm elastosheet 6147.
 - .5 Heavy duty elastomeric reinforcing membrane: to manufacturer standard, width 900 mm elastosheet 6146.

- .6 Cement: to CSA A5.
- .7 Separation sheet: to CGSB 70-GP-1, polyethylene film, 4 mm thick.
- .8 Protection board: 6 mm thick, water resistant board W.R. Meadow manufacture, "Vibraflex", to protect membrane from site damage.
- .2 Damp proofing: to CBSB 37-GP-2M, waterproof emulsion, asphalt dispersed in mineral colloid emulsifier, brush consistency, permeability 0.14 perms, "Bakelite 700-01", Bakelite Thermosets Ltd. Manufacture.
- .3 Sheet membrane: sheet EPDM, minimum 45 mm thick, c/w manufacturer standard adhesive, full sizes required, Marathon Equipment.

Part 3 EXECUTION

3.1 INSPECTION

- .1 Inspect surfaces, areas to receive waterproofing and damp proofing. Report defects and unsuitable conditions.
- .2 Ensure surfaces are firm are straight, smooth and dry.
- .3 Ensure surfaces are free of snow, ice, frost, concrete fins, projections, large holes. Sweep clean of dust and debris.
- .4 Ensure all protrusions, drains, connected mechanical, electrical piping, conduit, equipment installed.
- .5 Ensure cement parge coating on masonry surfaces to be waterproofed is dry, cured.
- .6 Inspect surfaces, intersections of material with work of Other Contractors. Report defects, unsuitable conditions.
- .7 Proceed when defects, unsatisfactory conditions corrected, other Sections, Other Contractors work complete.

3.2 PREPARATION

- .1 Obtain, make ready, prepare all materials. Cause no delays to scheduling.
- .2 Prepare all surfaces to receive waterproofing, damp proofing.
- .3 Ensure independent specialist has examined surfaces to be covered, prior to commencing waterproofing, damp proofing.

3.3 PREPARING CONCRETE SURFACES FOR MEMBRANE WATERPROOFING

- .1 Ensure concrete surfaces properly cured.
- .2 Remove curing agents, oils, form break materials, other deleterious mater.
- .3 Fill holes, rough surfaces over 12 mm deep, openings around stacks, drains, etc., with portland cement concrete, leveled smooth.

- .4 Fill holes, rough surfaces, small depressions not over 12mm deep with cement, sand-asphalt mix, leveled smooth, to following proportions by volume:
 - o One (1) part portland cement;
 - o Four (4) parts clean sand;
 - o 1-1/8 part asphalt emulsion to 37-GP-28M; and,
 - o 1/8 part clean, cool water.

3.4 APPLYING MEMBRANE WATERPROOFING

- .1 Ensure surfaces clean and dry.
- .2 Do not apply in temperatures below four point four (4.4) degrees C.
- .3 Ensure concrete surfaces wood float finished or better. Ensure surfaces free of loose concrete, films of oil, grease, debris, curing compounds, dust, frost, dampness.
- .4 Apply membrane waterproofing systems where indicated, required, to concrete roof surfaces, wall surfaces, other surfaces to be waterproofed, returned down wall, up wall adjacent surfaces, other surfaces indicated, required, above, below grade, etc.
- .5 Apply conditioner to entire concrete surface areas to be membrane waterproofed, evenly to all surfaces, maximum rate 3.8L per 18 sq. m, minimum rate 3.8L per 27 sq. m. depending on concrete surface. Allow to dry.
- .6 Provide waterproof membrane in 22 kg cakes, meeting manufacturer specifications.
- .7 Melt membrane cakes in approved, double shell melter, under continuous agitation until material free flowing; lump free from kettle at temperatures no greater than two-hundred and eighteen point three (218.3) degrees C.
- .8 Do not melt cakes in direct heat type kettles.
- .9 Do no use or allow open flame to aid material application by remelting.
- .10 Apply membrane evenly in two (2) coats, at rate 3.40 kg per sq. m per coat. Apply first coat in one direction, second coat at right angles while first coat still hot to provide continuous coating, not less than 4.8 mm, averaging 6.35 mm thick.
- .11 Embed strips reinforcing fabric in waterproofing membrane over construction joints, all joints occurring along lengths precast concrete roof slabs, other locations, cracks up to 1 mm wide; strips standard elastomeric reinforcing membrane over non-moving construction joints, cracks over 1mm, less than 6.35 mm wide, at junction horizontal, vertical surfaces, changes in plane, where indicated, required.

- .12 Place strips reinforcing fabric, elastomeric membrane reinforcing along joint, crack extending minimum 150 mm either side, roll down into rubberized asphalt membrane while still warm.
- .13 Apply strip heavy duty elastomeric reinforcing membrane at all expansion joints up to 12 mm wide, with designed, total movement less than fifty (50) percent, at all cracks exceeding 6 mm in width.
- .14 Loop elastomeric reinforcing membranes minimum 150 mm each side of joint, fill expansion joint loop to finished level with waterproofing membrane.
- .15 Extend elastomeric reinforcing membranes minimum 150 mm each side of joint, fill expansion joint loop to finished level with waterproofing membrane.
- .16 Apply two (2) layers elastomeric reinforcing membrane with alternate coatings waterproofing membrane trowelled in where reinforcing membrane may be subject to unusual strain.
- .17 Carry waterproofing membrane to minimum limits shown, required, advise Contract Administrator in writing, if other special measures required for proper installation.
- .18 Carry waterproofing membrane up over concrete curbs, etc., turn up, down at vertical angles on walls, other surfaces indicated, required.
- .19 Embed minimum 460 mm sq. drain flanges between two (2) layers membrane, secured by clamping rings, centered over drains. Seal around vents, pipes, conduit, rebar penetrating membrane plane.
- .20 Apply polyethylene separation sheet with lapped joints before insulation is placed, when waterproofing membrane cooled, still tacky, before becoming dusty.
- .21 Install protection board under all poured concrete slabs, curbs, etc. secured directly on top of membrane.

3.5 APPLYING DAMPPROOFING

- .1 Apply damp proofing prior to application of waterproofing, insulation systems.
- .2 Apply one (1) brush primer coat dampproofing to exterior concrete wall surfaces above grade, down below grade, adjoining membrane waterproofing systems, behind insulation, where indicated, required, reduced twenty (20) percent with water, at rate 3.78 L per 10 sq. m.
- .3 Apply two (2) full brush coats dampproofing to primed areas, to manufacturer directions, at rate approximately 11.34 L per 10 sq. m.
- .4 Allow to dry thoroughly between coats.
- .5 Cover entire surfaces, no spots uncoated, no pin holes, open areas, make proper connection to/for other waterproofing materials.
- .6 Protect damp proofing against freezing during storage, application, from damage after application until covered with insulation, backfill placed.

3.6 PROTECT OF FLEXIBLE MEMBRANE WATERPROOFING

- .1 Avoid damage to waterproofing after applications.
- .2 Membrane shall be covered with insulation within thirty (30) days of application.
- .3 Provide necessary temporary protection, covering to prevent damage by mechanical gouging, scraping, squeezing, oil or solvent spillage and excessive heat until insulation is applied.
- .4 Protect membrane on vertical surfaces to be backfilled with protection board placed against waterproofing membrane as backfill placed.
- .5 Protect membrane with 6 mm hick asphalt impregnated protection board with 300 mm wide paper joint covers, after membrane cooled, dusted with cement powder, free from lumps, at rate one (1) bag per 100 sq. m.

3.7 APPLYING SHEET MEMBRANE

- .1 Apply sheet membrane in full width, length in strict accordance with manufacturer instructions.
- .2 Ensure concrete, other surfaces prepared to receive membrane without damage.
- .3 Apply membrane starting at lowest point, where indicated, required, lapping joints minimum 50 mm, set in full coat adhesive for complete bond. Seal joints at completion, prior to application metal flashings over.

3.8 EXAMINATION/TESTING

- .1 Independent specialist, examining and testing company as appointed by Contractor, approved by Contract Administrator shall review all aspects of waterproofing, damp proofing work.
- .2 Specialist examiner has authority to initiate minor 'no cost' changes to details, to suit job site conditions.
- .3 Waterproofing, damp proofing examination shall be in accordance with inspection procedures outlined by Contract Administrator to ensure waterproofing, damp proofing adequate, watertight, including:
 - .1 Preliminary examination to ensure surfaces in proper condition to receiving waterproofing, damp proofing, notification to Contractor of deleterious conditions not corrected;
 - .2 Study of waterproofing specification, notification to Section 07 10 00 - Waterproofing Systems of any variances, discrepancies between good waterproofing practices, that specified;
 - .3 Examination of waterproofing, damp proofing materials on site, notification to Contract Administrator of variances from specified materials; and,

- .4 Examination of workmanship, installation of waterproofing, damp proofing materials, minimum one trip per day during any waterproofing, damp proofing operation, made early each working day.
- .4 Specialist examining and testing company shall submit written reports. Submit duplicate typewritten report, within one (1) week final examination of any completed area, based on examination trips, results of examinations, in accordance with outlined procedures for examinations.
- .5 Specialist Examining and test company shall take photographs of Work in process, condition of surfaces, submit with written reports. Photographs shall state vantage point, date taken, any peculiarities or comments.

3.9

CLEAN UP

- .1 Clean up rubbish ,debris and packaging resulting from Work promptly as Work proceeds, at completion, at other times directed by Contractor. Remove from job Site. Remove bitumen from metal flashings, surrounding surfaces.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Provide all labour, materials, methods, equipment and accessories to complete all modified bitumen sheet roofing, sheet metal Work.
 - .1 Gypsum board roof sheathing.
 - .2 Roofing vapour retarder and primer.
 - .3 Roof insulation, tapered insulation fill.
 - .4 Modified bitumen sheet roofing.
 - .5 Membrane flashings in roofing.
 - .6 Caulking, sealing roofing, flashings.
- .2 Install prefinished flat stock sheet metal, formed prefinished cap, and flashings.

1.2 RELATED SECTIONS

- .1 Section 07 62 00 – Sheet metal flashings, roof scuppers, etc.

1.3 SHOP DRAWINGS/ MAINTENANCE

- .1 Submit full size details, largest scale possible of sheet metal work, pitch pockets, parapet drains, scuppers, expansion joints, control joints, equipment opening curbs, miscellaneous details, etc.
- .2 At completion provide roof maintenance manual.

1.4 REGULATORY REQUIREMENTS

- .1 Perform roofing work to procedures, methods established by Canadian Roofing Contractors Association (CRCA) except as specified otherwise.
- .2 Comply with applicable requirements of ULC, local authority having jurisdiction.

1.5 ENVIRONMENT

- .1 Comply with manufacturer directions, restrictions when temperature falls below zero (0) degrees Celsius. follow cold weather procedures, ensure full proper bond using additional asphalt glaze coating 9 kg square to base membrane with torch welding methods as directed by manufacturer.
- .2 Protect work, materials from snow, rain.
- .3 precipitation.
- .4 Remove, replace vapour retarder damaged by weather.

1.6 WARRANTY

- .1 Extend warranty required by General Condition GC 12.3, Standard Construction Document CCDC2 1994, to period two (2) years from date of Substantial Performance of the Work.

- .2 Provide material manufacturer/supplier material warranty for leak proof warranty limited to cost of repairs including material replacement, labour costs necessary to maintain roof areas in watertight condition for period five (5) years from date of Substantial Performance, with inspection at end of two (2) years and any deficiencies made good by Roofing Contractor as approved applicator.

Part 2 Products

2.1 MATERIALS

- .1 Gypsum board sheathing: to CSA A82.27, Type X, 12mm hick, Canadian Gypsum, Domtar manufacture.
- .2 Vapour retarder sheet: to CGSB-37.56-M, 9th draft Elastophene SP 2.2, Soprema Inc. manufacture.
- .3 Roof insulation.
 - .1 Poly-isocyanurate: to CAN/CGSB-51.26-M86, FM Class 1, R7 per 1" thickness, 50 mm or 25 mm layers as noted, board size 1200 mm x 2400 mm, square edged, Celotex Corporation manufacture, "Thermax Hy-Therm AP".
 - .2 Tapered insulation: to CGSB 51-GP-20M, type 2, moulded expanded polystyrene, square edges, R4 per inch thickness, tapered as required to produce roof system slope approximately 9 mm per meter of slope in roof areas as indicated, required, minimum thickness 1 mm, sizes required.
 - .3 Fireguard tape, self-adhesive fire stop membrane, Soprema Inc. manufacture.
 - .4 Membrane base sheet, base sheet flashing Colvent -810, Soprema Inc. manufacture.
 - .5 Membrane cap sheet, cap sheet flashing Sopraply Traffic Cap -560, soprema Inc. manufacture.
 - .6 Primer: Concrete, gypsum board primer: Soprema manufacture "Elastocol 500".
- .4 Accessories:
 - .1 Roofing nails: to CSA B111-1974, Table 12, large head galvanized steel nails, length to penetrate wood minimum 12 mm, plywood minimum 19 mm.
 - .2 Gypsum board fasteners: #10 flat counter-sunk head, self-tapping, cadmium plated, 19 mm long.
 - .3 Insulation fasteners: Power driven screw type, self-drilling, recessed hexagon plate washer, screw length to penetrate insulation, steel deck minimum 25 mm, Anchor Construction Products distributor "Dekfast" system.
 - .4 Insulation fasteners to concrete: pre-drilled screw type, corrosion resistant finish, recessed hexagon plate washer, screw length to

penetrate insulation, concrete deck minimum 25 mm Anchor
Construction Products "Confas" system.

- .5 Sheet metal: galvanized sheet metal to ASTM A526-80, commercial quality, minimum 24 ga. nominal core thickness, type, gauge thickness. Form as required by new roofing system.

Part 3 Execution

3.1 GYPSUM BOARD SHEATHING ON STEEL DECK

- .1 Mechanically fasten gypsum board with screw fasteners, washers maximum 30 mm o.c. around board perimeter, 600 mm o.c. down centre 1200 mm wide board.

3.2 VAPOUR BARRIER ON CONCRETE, GYPSUM BOARD STEEL DECKS

- .1 Apply coating of primer cold to concrete, gypsum board deck areas to receive membrane vapour retarder. As per manufacturers recommendations.
- .2 Install membrane vapour retarder in accordance with manufacturer instructions.
- .3 Apply membrane with minimum side and end laps of 75 mm fused together. Provide surface free of air pockets, wrinkles, fishmouths, etc.
- .4 Return membrane vapour retarder up parapet walls to connect with wall construction vapour barrier, fully seal.

3.3 APPLYING ROOF INSULATION

- .1 Place tapered insulation to provide roof area back sloping, crickets, etc. as indicated, required for proper drainage. Do all cutting to fit insulation into place. Stagger, offset joints.
- .2 Place layers of poly-isocyanurate insulation to, sloped insulation surfaces.
- .3 Mechanically fasten poly-isocyanurate insulation to concrete deck, steel deck through vapour retarder, gypsum board sheathing with minimum five fasteners each 1200 mm x 1200 mm insulation board, and ten fasteners for each 1200 mm x 2400 mm insulated board, positioned to penetrate steel deck top flutes, in accordance with manufacturer directions.
- .4 Co-operate with installation required blocking, etc. at roof edges, around roof mounted apparatus, at junction roof deck, vertical surfaces, curbs, other locations required.

3.4 MODIFIED BITUMEN ROOFING MEMBRANE APPLICATION

- .1 Unroll base sheet dry over insulation for alignment, starting from low point. Each strip shall have 75 mm side laps, 25 mm end laps. Remove release paper and allow the sheet to adhere.
- .2 Seal side and end joints and install mechanical fasteners as per manufactures specifications.

- .3 After base flashing membranes are installed, apply cap membrane sheet granular side up. Fully heat-welded to base sheet.
- .4 Lap sides 75 mm, ends 150 mm, minimum 300 mm offset from underlying laps of base sheet. Seal laps watertight by torching.
- .5 Apply only membrane that can be completed same day. Replace damaged membranes.

3.5 MEMBRANE FLASHING

- .1 Apply base, cap sheet membrane as flashings in conjunction with metal flashings, etc. in strict accordance with manufacturer directions using torched on adhesion welding method for cap sheet flashing membranes as required.

3.6 INSTALLING FLASHINGS

- .1 Complete roofing membrane system, membranes flashings, metal flashings, scuppers etc. as required and detailed all to meet manufactures recommendations.
- .2 Install roof jacks, metal caulking retainers, vent stack flashings, expansion joint flashings, other items, etc.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Provide all labour, materials, methods, equipment, accessories to complete sheet metal flashings, metal covers and water drainage, trim work etc.
- .2 Fabrication.
- .3 Galvanized and prefinished metal block flashing, other flashings indicated.
- .4 Galvanized and prefinished metal wall cladding flashing.
- .5 Galvanized and prefinished covers, eave and rake drip edges, fascia trim, etc.
- .6 Prefinished metal rain water scuppers, downspouts, accessories, c/w elbows, drops, end caps, etc.
- .7 Prefinished metal window, door opening flashings, etc.
- .8 Other galvanized or prefinished sheet metal work indicated, required.
- .9 Required accessories, installation clips, angles, bolts, fasteners.
- .10 Caulking, backup material, sealing, bedding.

1.2 SHOP DRAWINGS

- .1 Submit Shop Drawings.
- .2 Indicate materials, profiles in large scale, construction of various parts, methods of joining, thickness, types of materials, finishes, anchorage details, joints, fastenings, sealants, adjacent materials, etc.

Part 2 Products

2.1 MATERIALS

- .1 Galvanized sheet metal: to ASTM A526-80, commercial quality, minimum 26 gauge nominal core thickness, thickness indicated, required, Z275 zinc coating to ASTM A525-M.
- .2 Prefinished galvanized sheet metal: baked enamel, Stelcolour 5000 series, minimum 1 mil thick including primer, colour selected by Consultant.

2.2 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint to CGSB 1-GP-108, Type 2.
- .2 Plastic cement: to CGSB 37-GP-5Ma, plastic cut-back asphalt, Domtar manufacture "Fibregum".
- .3 Sealing compound: to CGSB 37-GP29M, rubber asphalt type.

- .4 Cleats: same material, temper, thickness as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .5 Fasteners: of same material as sheet metal, to CSA B111, ring thread, flat head roofing nails, length and thickness suitable for metal flashing application.
- .6 Fasteners: purpose-made standard screw type approved by Consultant, oval head, sealing washers where indicated, required, sized to meet application requirements, exposed heads colour matched to attached materials.
- .7 Caulking: manufacturer's standard, colour matched to adjacent materials. Provide approved rain water gutter interior sealing compound.

2.3 FABRICATION

- .1 Comply with dimensions, profile limitations, gauges, fabrication details shown, detailed on shop, erection drawings.
- .2 Fabricate components at factory, ready for field assembly in maximum lengths.
- .3 Form metal flashings, cap, roof flashings, window sill, concrete block wall base flashings, over lintels, miscellaneous flashings, etc. to profiles indicated, required from minimum 26 gauge galvanized sheet steel, prefinished, required, to Consultant approval.
- .4 Form pieces in maximum 1800 mm lengths. Make allowance for expansion at joints.
- .5 Hem exposed edges on underside 12 mm where abutting other surfaces, supporting soffit panels as indicated, required. Mitre, seal corners with sealant.
- .6 Form wall scuppers, downspout sections, etc. from minimum 22 gauge thick prefinished sheet steel to profiles, sizes indicated, required.
- .7 Form eave gutters to widths indicated, required with insert drop connectors to 150 mm x 150 mm square closed and open downspouts as indicated, c/w corners, elbows, end deflectors, brackets, etc. required.
- .8 Allow for expansion, contraction, seal joints, connection watertight.

Part 3 Execution

3.1 INSTALLATION

- .1 Install sheet metal work in accordance with CRCA specifications, manufacturer instructions, in conjunction with other Sections.
- .2 Use concealed fastenings except where approved before installation.
- .3 Counterflash bituminous flashings at intersection of flat roof areas with vertical wall surfaces, curbs, etc. Form joints using S-lock, tight fit over hook strips, as indicated.
- .4 Form metal counter flashing with hemmed edges, locked joints. Extend to bottom of cant, in moderate contact with roof surface.

- .5 Secure by concealed nailing at lock joints along top edge of blocking, adjoining surfaces.
- .6 Do not fasten through roof membrane.
- .7 Secure flashings to wood backing, other surfaces with galvanized nails, neoprene washers prior to finish material application, co-operate with other Sections.
- .8 Secure fascia covers with purpose made fasteners maximum 400 mm o.c.
- .9 Lock end joints, caulk with sealant.
- .10 Secure metal flashing to other materials, form weathertight junction.
- .11 Caulk cap, other flashings to other materials, surfaces with sealant.

END OF SECTION

Part 1 General

1.1 Qualifications

- .1 Only competent and qualified tradesmen shall execute the work of this section, using adequate plant facilities and equipment.

1.2 Protection

- .1 Exercise care when working on or about roof surface to avoid damaging or puncturing membrane or membrane flashings.
- .2 Place plywood panels on roof surfaces adjacent to work of this section. Keep in place until completion of the work.

Part 2 Products

2.1 Materials/Compounds

- .1 Gutters and Downspouts: minimum 0.61 mm (24 ga.) Galvalume sheet steel coating conforming to CSA S136-94, Grade 230, coating designation AZ150 with Barrier Series factory applied enamel finish. Colour to match fascias.
- .2 Bituminous Paint: Acid and alkali resistant type; black colour; conforming to requirements of CGSB 1-FP-108c.
- .3 Anchorage Devices: Type recommended by manufacturer and acceptable to the Contract Administrator.
- .4 Splash Pads: Precast concrete, 280 mm x 760 mm.

Part 3 PART 3 - Execution

3.1 Installation

- .1 Fabricate gutters on site in continuous lengths, minimum 125 mm width.
- .2 Install gutters and downspouts where indicated on drawings. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- .3 Apply bituminous paint on all surfaces to be in contact with dissimilar materials.
- .4 Slope gutters minimum 6 mm per 1220 mm.
- .5 Set splash pads under downspouts where and as indicated on drawings.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Heat tracing cables and related equipment for snow and ice melt system.

1.2 REFERENCES

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

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 SNOW AND ICE MELT HEAT TRACE SYSTEM

- .1 Design and supply a complete snow and ice melt system for a concrete pad as indicated on the drawings.
- .2 System shall be designed to operate in Winnipeg, Manitoba.
- .3 Ambient temperature thirty (30) degrees below Celsius.
- .4 Design to include selection of heating cable, installation details for spacing and layout, controls, and physical protection.
- .5 System designed to operate at 347/600 VAC.

2.2 HEAT TRACE CABLES

- .1 Cables to be mineral insulated, copper conductors, compacted magnesium oxide insulation, and seamless alloy 825 sheath.
- .2 Voltage: 347/600 VAC
- .3 Complete with cold lead of sufficient length for termination on building interior

2.3 CONTROL ENCLOSURE

- .1 NEMA 12 enclosure

- .2 Enclosure to house contactors, ground fault monitoring relays, hand-off-auto switch, and indicating lights

2.4 TEMPERATURE CONTROLS

- .1 Adjustable remote bulb type control thermostat, four (4) degrees below Celsius to one hundred and sixty-three (163) degrees Celsius.
- .2 Rating 120 VAC, 22 amps.
- .3 NEMA 4 housing.
- .4 Capillary length: 3000 mm

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install heating cables in accordance with manufacturer's instructions. Co-ordinate installation with reinforcing steel and concrete works.
- .2 Fasten cables to reinforcing steel at intervals required by manufacturer.
- .3 Heating cables shall not cross.
- .4 Install rigid galvanized steel conduit sleeves through foundation walls for heating cables and temperature thermostat.
- .5 Install rigid galvanized steel conduits across control joints
- .6 Mount power feed junction boxes in basement.
- .7 Test heating cables prior to concrete pour.
- .8 Make power and control connections.

3.3 FIELD QUALITY CONTROL

- .1 Use Megger to test cables for continuity and insulation value and record readings before, during and after installation.
- .2 Provide test results to Contract Administrator prior to concrete pour.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 General requirements that are common to NMS sections found in Section 26 – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
- .2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

- .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

.4 City of Winnipeg Water and Waste Department – Electrical Design Guide, Rev 01

.5 City of Winnipeg Water and Waste Department – Automation Design Guide, Rev 00

.6 City of Winnipeg Water and Waste Department – Identification Standard, Rev 00

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

1.4 SUBMITTALS

.1 Quality Control:

- .1 Provide CSA certified equipment and material.
- .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to Site.
- .3 Submit test results of installed electrical systems and instrumentation.

- .4 Permits and fees: in accordance with General Conditions of Contract.
- .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.
- .2 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within three (3) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in Part 3 - Field Quality Control.

1.5 QUALITY ASSURANCE

- .1 Quality Assurance:
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.6 SYSTEM STARTUP

- .1 Instruct City's personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Assist City's personnel and the Contract Administrator in the start-up of equipment.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.7 Site

- .1 Classification of Plant Areas
 - .1 Building: Ordinary

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to Site and submit such approval as described in Part 1 - Submittals.
- .2 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Division 29.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of inspection authorities.
- .2 Lamacoid signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates: lamacoid 3 mm thick plastic engraving sheet, white with black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping stainless steel screws.
 - .2 Lamacoids as follows:

Application	Text Size	Text
Electrical Equipment - General	5 mm	Line 1: Identifier
Circuit Breaker - Separate	5 mm	Line 1: Identifier Line 2: Load Identifier Line 3: Load Description
Disconnect Switch - Separate	5 mm	Line 1: Identifier Line 2: Load Identifier Line 3: Load Description
Fire Alarm Devices	8 mm	Line 1: Identifier
Light Switches	3 mm	Source Panel and Circuit Number
Motor Control Centre	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Motor Starter or MCC Bucket	5 mm	Line 1: Load Identifier Line 2: Load Description
Panelboards	8mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Receptacles	3 mm	Source Panel and Circuit Number
Switchgear	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By

Switchgear Breaker	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Transformer - Indoor	8 mm	Line 1: Identifier Line 2: Rating, System Voltage Line 3: Fed By
Transformer – Outdoor	10 mm	Line 1: Identifier Line 2: Rating, System Voltage Line 3: Fed By

- .2 Wording on nameplates to be approved Contract Administrator prior to manufacture.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes, and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.
- .4 Colour Codes

	Prime	Auxiliary
Power, 120/208/240 VAC	Black	
UPS Power, 120/208/240 VAC	Black	Green
Control Wiring, 120VAC	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring, <50 V	Blue	Orange
Intrinsically Safe	Blue	White
Up to 250 V	Yellow	
Up to 600 V	Yellow	Green
Other Communication Systems	Green	Blue

- .5 Cable Colour Codes

	Prime	Auxiliary
Power, 120/208/240 VAC	Black	
UPS Power, 120/208/240 VAC	Black	Green
Control Wiring, 120VAC	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring, <50 V	Blue	Orange
Intrinsically Safe	Blue	White
Up to 600 V	Yellow	Green
Other Communication Systems	Green	Blue

2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish.
 - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Control panels: as indicated.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays, and fuses are installed to required values and settings.

3.5 FIELD QUALITY CONTROL

- .1 Conduct following tests:
 - .1 Circuits originating from branch distribution panels.
 - .2 Lighting and its control.
 - .3 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .2 Carry out tests in presence of Contract Administrator.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of Project.

3.6 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors;
 - .2 Clamp for stranded copper conductors;
 - .3 Stud clamp bolts;
 - .4 Bolts for copper conductors; and,
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

- .1 CSA C22.2 No.0.3, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No.131, Type TECK 90 Cable.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with thermoplastic insulation type TWU or TWH rated at 600 V.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No.131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 One-hole stainless steel straps to secure surface cables 50 mm and smaller. Two-hole stainless steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two (2) or more cables at 900 mm centers.
 - .3 Stainless steel threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors

2.3 CONTROL CABLES

- .1 Type LVT: soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.
- .2 600 V type: stranded annealed copper conductors, sizes as indicated with PVC insulation type TW, or cross-linked polyethylene type RW90 (x-link with shielding of metallized tapes over each pair of conductors and overall covering of thermoplastic jacket interlocked armour and jacket over sheath of PVC.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install building wiring in ordinary locations as follows:
 - .1 In conduit systems in accordance with Section 260534

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install Teck cables for direct buried applications.
 - .1 Group cables wherever possible on channels.
- .2 Lay cable in cabletroughs/cable tray in accordance with Section 26 05 36.
- .3 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA International)

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated.
- .3 Rod electrodes: copper clad steel 19 mm dia. by 3 m long.
- .4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .5 Insulated grounding conductors: green, type RW90.
- .6 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.
- .7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings;
 - .2 Protective type clamps;
 - .3 Bolted type conductor connectors;
 - .4 Thermit welded type conductor connectors;
 - .5 Bonding jumpers, straps; and,
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .10 Ground secondary service pedestals.

3.2 ELECTRODES

- .1 Install rod electrodes and make grounding connections.
- .2 Bond separate, multiple electrodes together.
- .3 Use size 2/0AWG copper conductors for connections to electrodes.

3.3 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.4 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.5 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections sized in accordance with the Canadian Electrical Code.

3.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to Site conditions and to approval of Contract Administrator.
- .3 Perform tests before energizing electrical system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Not Used

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape aluminum, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole stainless steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole stainless steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.
 - .2 Support two (2) or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two (2) or more conduits use channels at 1 m on center spacing.
- .8 Provide metal brackets, frames, hangers, clamps, and related types of support structures where indicated or as required to support conduit and cable runs.

- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit Shop Drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three (3) spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T: sheet steel cabinet, with hinged door, latch, lock, two (2) keys, containing sheet steel backboard for surface mounting.

Part 3 Execution

3.1 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated in Type T cabinets.

- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.1, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one (1) system are grouped.

2.2 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.3 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2 Rigid PVC (Un-plasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Flexible Non-metallic Tubing.

Part 2 Products

2.1 CONDUITS

- .1 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .2 Rigid metal conduit: to CSA C22.2 No. 45, galvanized threaded.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings
- .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

- .1 One-hole aluminum or stainless steel straps to secure surface conduits 50 mm and smaller. Two-hole aluminum or stainless steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1 m o.c.
- .4 Stainless steel threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 X-ray cast walls and floors before coring to confirm location of embedded items.
- .3 Existing structure may contain asbestos. Confirm materials are free of asbestos before drilling or coring.
- .4 Use rigid metal conduit in areas subject to mechanical injury.
- .5 Use EMT conduit inside building areas.
- .6 Use PVC coated conduit underground
- .7 Use rigid metal conduit in cast concrete.
- .8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.
- .9 Minimum conduit size for lighting and power circuits: 19 mm.
- .10 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .11 Mechanically bend steel conduit over 19 mm dia.
- .12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .13 Install fish cord in empty conduits.
- .14 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

- .15 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

- .1 Paint walls before installation of electrical equipment including conduits.
- .2 Run parallel or perpendicular to building lines.
- .3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .4 Run conduits in flanged portion of structural steel.
- .5 Group conduits wherever possible on suspended or surface channels.
- .6 Do not pass conduits through structural members except as indicated.
- .7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Do not place conduits in slabs in which slab thickness is less than four (4) times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.4 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 Canadian Standards Association, (CSA International)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 CABLE PROTECTION

- .1 38 mm x 140 mm planks pressure treated with copper naphthenate or five (5) percent pentachlorophenol solution, water repellent preservative.

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

- .1 After 75 mm sand bed is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Make termination and splice only as indicated leaving 0.6 m of surplus cable in each direction.
 - .1 Make splices and terminations in accordance with manufacturer's instructions using approved splicing kits.
- .4 Underground cable splices not acceptable.
- .5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, eight (8) times diameter of cable; for metallic armoured cables, twelve (12) times diameter of cables or in accordance with manufacturer's instructions.
- .6 Cable separation:
 - .1 Maintain 75 mm minimum separation between cables of different circuits.
 - .2 Maintain 300 mm horizontal separation between low and high voltage cables.
 - .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.

- .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
- .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
- .6 Install treated planks on lower cables 0.6 m in each direction at crossings.
- .7 After 75 mm sand protective cover spec is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks as indicated to cover length of run.

3.2 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
 - .1 Do not pull spliced cables inside ducts.
- .2 Install multiple cables in duct simultaneously.
- .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4 To facilitate matching of colour coded multi-conductor control cables reel off in same direction during installation.
- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.

- .2 Ground shields, ground wires, metallic armour and conductors not under test.
- .7 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (DryType).
 - .2 CSA C9, Dry Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)

1.4 PRODUCT DATA

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

Part 2 Products

2.1 TRANSFORMERS

- .1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2 No.47.
- .2 Design.
 - .1 Type: ANN.
 - .2 Windings: Copper
 - .3 Rating as specified.
 - .4 Voltage taps: standard.
 - .5 Insulation: 180 degrees C temperature rise.
 - .6 Basic Impulse Level (BIL): standard.
 - .7 Hipot :standard.
 - .8 Average sound level: standard
 - .9 Impedance at 17 degrees C: standard
 - .10 Enclosure: CSA 1, removable metal front panel c/w sprinkler shield.
 - .11 Finish: in accordance with Section 26 05 01 – Common Work Results – Electrical.
 - .12 Acceptable manufactures: Schneider Electric, Eaton, Rex Manufacturing.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Nameplate wording example:
 - T-2
 - 15kVA
 - 600V – 120/208V

Part 3 Execution

3.1 INSTALLATION

- .1 Mount dry type transformers up to 75 kVA as indicated.
- .2 Mount dry type transformers above 75 kVA on floor.
- .3 Ensure adequate clearance around transformer for ventilation.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Make primary and secondary connections in accordance with wiring diagram.
- .8 Energize transformers after installation is complete.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity, and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one (1) manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 600 V panelboards: bus and breakers rated for 18 kA (symmetrical) interrupting capacity or as indicated.
- .3 250 V panelboards: bus and breakers rated for 10 kA (symmetrical) interrupting capacity or as indicated.
- .4 Panelboard width to be less than 230 mm.
- .5 Integral TVSS.
- .6 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

- .7 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .8 Two (2) keys for each panelboard and key panelboards alike.
- .9 Copper bus with neutral of same ampere rating as mains.
- .10 Mains: suitable for bolt-on breakers.
- .11 Trim with concealed front bolts and hinges.
- .12 Trim and door finish: baked grey enamel.
- .13 Approved manufacture: Schneider Electric, Eaton

2.2 BREAKERS

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Lock-on devices for fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on U-channel. Where practical, group panelboards on common supports.
- .3 Mount panelboards to height specified in Section 26 05 00 – Common Work Results – Electrical.

- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Measure load current on each phase and adjust phase loading for a balanced system.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit Shop Drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 SWITCHES

- .1 20 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire
 - .2 Silver alloy contacts
 - .3 Urea or melamine moulding for parts subject to carbon tracking
 - .4 Suitable for back and side wiring
 - .5 Ivory toggle
- .3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to eighty (80) percent of rated capacity of motor loads.
- .4 Switches of one (1) manufacturer throughout project.
- .5 Acceptable materials: Leviton specification grade, Hubbell specification grade.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Ivory urea moulded housing;
 - .2 Suitable for No. 10 AWG for back and side wiring;
 - .3 Break-off links for use as split receptacles;
 - .4 Eight (8) back wired entrances, four side wiring screws; and,
 - .5 Triple wipe contacts and riveted grounding contacts.
- .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Ivory urea moulded housing;
 - .2 Suitable for No. 10 AWG for back and side wiring; and,
 - .3 Four (4) back wired entrances, 2-side wiring screws
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable materials: Leviton specification grade, Hubbell specification grade.

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one (1) manufacturer throughout project.
- .3 Sheet stainless steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .5 Stainless steel or cast aluminum cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.

- .2 Install switches in gang type outlet box when more than one (1) switch is required in one (1) location.
- .3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one (1) location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results – Electrical.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Include time-current characteristic curves for breakers with ampacity of 90 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5.
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for forty (40) degrees Celsius ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from three (3) to eight (8) times current rating.
- .5 Circuit breakers to have minimum symmetrical rms interrupting capacity rating matching panel board or switchboard containing breaker.

2.2 THERMAL MAGNETIC BREAKERS [DESIGN A]

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

2.3 MAGNETIC BREAKERS [DESIGN B]

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 SOLID STATE TRIP BREAKERS [DESIGN D]

- .1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.
- .2 Set adjustable trip settings according to coordination study.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
 - .2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 SUBMITTALS

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

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Heavy duty non-fusible, horsepower rated disconnect switch to CAN/CSA C22.2 No.4.
- .2 Provision for padlocking in OFF position.
- .3 Quick-make, quick-break action.
- .4 ON-OFF switch position indication on switch enclosure cover.
- .5 Ordinary locations: NEMA 12.
- .6 Outdoor: NEMA 3.
- .7 Acceptable Manufacturer: Square D, Eaton, Hubbell, Pass & Seymour, Leviton.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – For Electrical.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches as indicated and as required by CSA C22.1.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for industrial control devices including pushbutton stations, control and relay panels.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.14, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Include schematic, wiring, interconnection diagrams.

1.5 QUALITY ASSURANCE

- .1 Submit to Contract Administrator copy of test results.

Part 2 Products

2.1 AC CONTROL RELAYS

- .1 Control Relays: to CSA C22.2 No.14.
- .2 Fixed contact plug-in type: general purpose heavy duty with two (2) poles. Coil rating: 120 V. Contact rating: 240V, 2 A.

2.2 RELAY ACCESSORIES

- .1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 OILTIGHT LIMIT SWITCHES

- .1 Snap action type: roller, rod, fork, lever, top, side, push, wobble stick actuator, CSA type 4 enclosure. Contact rating 240VAC, 2A

2.4 SOLID STATE TIMING RELAYS

- .1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact.
- .2 Operation: on-delay or off-delay.
- .3 Potentiometer: self contained to provide time interval adjustment.
- .4 Supply voltage: 120 V, AC, 60 Hz.
- .5 Temperature range: minus 20 to 60 degrees Celsius.
- .6 Output contact rating: maximum voltage 300 V AC or DC. Current: 2A
- .7 Timing ranges: field adjustable, minimum 0.1s, maximum 60 hours.

2.5 OPERATOR CONTROL STATIONS

- .1 Enclosure: CSA Type 4, surface mounting:

2.6 PUSHBUTTONS

- .1 Illuminated, Heavy duty Oil tight. Operator extend type, as indicated. Black, with 2-NO and 2-NC contacts rated at 10 A, AC, labels as indicated. Stop pushbuttons coloured red. Start pushbuttons coloured green

2.7 SELECTOR SWITCHES

- .1 Maintained three (3) position labelled as indicated heavy duty oil tight, operators wing lever contact arrangement as indicated, rated 120 V, 10A, AC.

2.8 INDICATING LIGHTS

- .1 Heavy duty Oil tight, full voltage, LED type, push-to-test, lens colour: as indicated, supply voltage: 120 V, lamp voltage: 120 V, labels as indicated.

2.9 CONTROL AND RELAY PANELS

- .1 CSA Type 12 sheet steel enclosure with hinged padlock-able access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.10 CONTROL CIRCUIT TRANSFORMERS

- .1 Single phase, dry type.
- .2 Primary: 600 V, 60 Hz ac.

- .3 Secondary: 120 V, AC.
- .4 Rating: 150 VA, or larger as required.
- .5 Secondary fuse: ampacity as required.
- .6 Close voltage regulation as required by magnet coils and solenoid valves.

2.11 THERMOSTAT LINE VOLTAGE

- .1 Wall mounted, for exhaust fan control.
- .2 Full load rating: 8A at 120 V.
- .3 Temperature setting range: Zero (0) to thirty (30) degrees Celsius.
- .4 Thermometer Range: Zero (0) to thirty (30) degrees Celsius.
- .5 Markings in five (5) degree increments.
- .6 Differential temperature fixed at one (1) degree Celsius.

Part 3 Execution

3.1 INSTALLATION

- .1 Install pushbutton stations, control and relay panels, control devices and interconnect.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one (1) section at time and check out operation of section.
- .3 Upon completion of sectional test, undertake group testing.
- .4 Check out complete system for operational sequencing.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS OF WORK

- .1 Supply, install and commissioning a complete instrumentation and control (I&C) system for the pumping station as shown on the Drawings and as specified herein.
- .2 Component subsystems of the I&C system will include, but are not limited to, the following:
 - .1 Primary elements and transmitters;
 - .2 Final control elements;
 - .3 RTU control panels;
 - .4 Instrumentation cabling;
 - .5 Instrumentation power supplies; and,
 - .6 Conduit and cable tray.
- .3 Where packaged, stand-alone control systems are supplied by others provide cabling to connect to the required remote monitoring and/or control functions. Provide end-to-end Commissioning of all required remote monitoring and/or control functions. Assist in ensuring the correct functionality of any equipment supplied by others.
- .4 Documentation referred to in Section 1.1.1 to include as a minimum:
 - .1 Records of as-built information for the complete instrumentation system.
- .5 Documentation provided is formatted as follows:
 - .1 Location Drawings – indicate in plan and/or elevation views where the instrument elements are physically located. These Drawings are provided to assist the Contractor in estimating the amount of cable and ducting required.
 - .2 Standard Details – provide a reference for installation, operation and other instructions pertinent to a particular device.
 - .3 Detailed Specification – lists qualifications, quality of materials and workmanship, and supplementary information.
- .6 Definitions
 - .1 Interpret specialized terms not explicitly defined herein in accordance with ISA-S51.1, NEMA-ICS-1, ANSI/IEEE-Std-100, and The Communications Standard Dictionary, by Martin H. Weik.
- .7 References
 - .1 This Specification contains references to the following Documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed Documents, the requirements of this Section prevail.

REFERENCE	TITLE
API RP550	Manual on Installation of Refinery Instruments and Control Systems, Part I--Process Instrumentation and Control Sections 1 Through 13
ASME Section VII	Rules for Construction of Pressure Vessels
ASTM B68	Seamless Copper Tube
ASTM D883	Terms Relating to Plastics
IEEE 100	Dictionary of Electrical and Electronic Terms
ISA RP7.1	Pneumatic Control Circuit Pressure Test
ISA RP12.6	Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations
ISA S5.4	Instrument Loop Diagrams
ISA S18.1	Annunciator Sequences and Specifications
ISA S51.1	Process Instrumentation Terminology
NEMA 250	Enclosures for Industrial Controls and Systems
NEMA ICS 1	General Standards for Industrial Control and Systems
NEMA ICS 2	Industrial Control Devices, Controllers, and Assemblies
NFPA 70	National Electrical Code (NEC)
SAMA PMC 17-10	Bushings and Wells for Temperature Sensing Elements
UBC	Uniform Building Code
UL 1012	Power Supplies
UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Weik, Martin H. Communications Standard Dictionary, Van Nostrand Reinhold Co.

.8 Related Work:

- .1 Mechanical
- .2 Electrical

.9 Qualifications

- .1 The instrumentation Subcontractor shall be a firm normally engaged and fully competent in the type of Work described in this Section of the Specification. The firm shall have been continuously and successfully engaged in this business for at least five (5) years.
- .2 Qualified journeyman instrument mechanics that are familiar with the devices being installed shall perform all instrument hook-ups, calibrations, and checkouts.
- .3 Qualified journeyman electricians shall perform all control wiring installation and connections.

.10 Codes, Rules, Permits, and Fees

- .1 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.
- .2 Comply with all rules of the Electrical Safety Act of the Province, CSA Standards, the ULC and the applicable building codes, whether specifically shown on Drawings or not.

- .3 Give all required notices, submit Drawings, obtain all permits, licenses and certificates and pay all fees required for this Work.
- .4 Furnish a certificate of final inspection and approvals from an inspection authority to the Contract Administrator.
- .11 Standards of Workmanship
 - .1 Execute all Work in a manner, which will result in the completed installation presenting an acceptable appearance, to a level of quality defined in the general conditions of this Specification.
 - .2 Employ a competent supervisor and all necessary licensed tradesmen to complete the Work in the required time.
 - .3 Arrange and install products to fit properly into designated building spaces.
 - .4 Install products in accordance with the recommendations and ratings of the product manufacturers.
- .12 Contract Drawings and Specifications
 - .1 Refer to Division 1.
 - .2 Provide all items and accessories required to install the City supplied equipment.
 - .3 Perform all operations as designated by the Specification according to the methods prescribed, complete with all necessary labour and incidentals.
 - .4 Treat any item or subject omitted from this Division's Specifications or Drawings, but which is mentioned or reasonably specified in other Divisions' Specifications or Drawings and pertains to the instrumentation and control system, as being integral to the overall system. Provide such specified items or subjects.
 - .5 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.
 - .6 If discrepancies or omissions in the Drawings or Specifications are found, or if intent or meaning is not clear, consult the Contract Administrator for clarification before submitting bid.

1.2 EQUIPMENT

- .1 Receiving, Storing, and Protection of Components during Construction
 - .1 Examine each component upon delivery to Site. Report all damage noted to the Contract Administrator prior to accepting or rejecting delivery. All instrumentation primary elements, control components, panels, etc. shall be placed in a secure, dry, heated storage building. Maintain the space temperature above ten (10) degrees Celsius and the space relative humidity below fifty (50) percent.
 - .2 Perform a preliminary examination upon delivery to ensure that:
 - .1 All instrumentation and control components supplied for this project under this Section of the Specification comply with the requirements stated in the instrument Specification sheets.

- .2 All instrumentation and control components supplied by others, to be connected to instrumentation and control components comply with the requirements stated in the Contract Documents.
- .3 Itemize all non-conformities noted above and forward them to the Contract Administrator.
- .4 Do not install primary elements or other sensitive equipment until construction is sufficiently completed to provide an "operating condition" environment. Notify the Contract Administrator prior to installing any equipment of this type.
- .5 Ensure that covers where required are properly installed on all equipment. Provide all covers, padding, guards, etc. as required to guard any equipment against damage.
Return all damaged equipment to the supplier for total corrective repairs. If deemed necessary by the Contract Administrator, the damaged equipment shall be replaced with new product.

1.3 SITE

- .1 Classification of Plant Areas
 - .1 Building: Ordinary

1.4 DOCUMENTATION

- .1 Submittals
 - .1 Submit Shop Drawings for all products supplied by this Division.
 - .2 Shop Drawings for the City supplied equipment will be provided to the Contractor
- .2 Construction Record Drawings
 - .1 Maintain on-site a complete set of Construction Record Drawings as listed in Division 1 of this Specification.
 - .2 In addition to the requirements as stated in Division 1, record the following information on the Drawings:
 - .1 All changes, alterations or additions;
 - .2 All instrumentation cable and control tubing; and,
 - .3 All changes to the numbers and location of outlets, motors, panels and end devices that may occur during the course of the Work.
 - .3 Before requesting the Certificate of Total Performance, make any necessary final corrections to the Drawings, sign each print as a certification of accuracy and deliver all sets to the Contract Administrator for approval.

Part 2 Products

2.1 GENERAL

- .1 Refer to the requirements of Division 1.

- .2 Selected Products:
 - .1 Provide products and materials that are new and free from all defects.
 - .2 The design has been based on the use of the first named product where multiple products have been listed.
- .3 Quality of Products
 - .1 All products provided to be CSA and ULC approved where applicable.
 - .2 If products specified are not CSA approved, obtain approval of the relevant provincial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.
 - .3 Refer to Division 1 of this Specification for further information.
- .4 Uniformity of Manufacture
 - .1 Unless otherwise specifically called for in the Specification, uniformity of manufacture to be maintained for similar products throughout the Work.
- .5 Use of Products During Construction
 - .1 Any equipment used for temporary or construction purposes is to be approved by the Contract Administrator. Clean and restore to "as new" condition all equipment prior to the time of Substantial Performance.

2.2 INSTRUMENTATION

- .1 General
 - .1 Instruments and installation methods to be suitable for the environmental conditions in which they are to be installed.
 - .2 Determine where injurious conditions may be expected to occur and make proper provision to protect the instruments to ensure their proper and reliable operation.

2.3 IDENTIFICATION

- .1 Refer to City of Winnipeg Water and Waste Department – Identification Standard, Rev 00 for general identification requirements.
- .2 Provide 3 mm thick lamicaid nameplates with 6 mm black lettering on white background. Identify the loop tag number (where applicable) and the device name, function, and instrument range or setpoint value on the nameplate.
- .3 Where it is not possible to attach a lamicaid nameplate to a field instrument component, provide the component with a stainless steel metal tag firmly wired to the device and identified with the loop tag number.
- .4 Identify all wires where they terminate at the marshalling panels, junction boxes and field devices with a heat shrink sleeve with machine printed labelling.
- .5 Clearly mark all panels, pull boxes, junction boxes, etc. to indicate the nature of service.
- .6 Provide neatly typed circuit directories for panel power distribution systems to indicate loops or devices powered by the circuit and the fuse size.

- .7 Identify all exposed control conduits at all pull box locations, where the conduits enter or leave a room, and 13 m on center throughout the room. This shall apply to conduits above removable ceilings. Use Thomas & Betts TY-RAP 5532-M labels conduit identification.
- .8 For direct current wiring use black for positive and white for negative.
- .9 For thermistor wiring to motors use red and blue coloured, insulated wire.

Part 3 Execution

3.1 SITE EXAMINATION

- .1 Refer to the requirements of Division 1.
- .2 No additional compensation will be given for extra Work due to existing conditions that a Site examination prior to Bid should have disclosed.

3.2 COORDINATION WITH OTHER DIVISIONS

- .1 Examine the Drawings and Specifications of all Divisions and become fully familiar the Work. Before commencing Work, obtain a ruling from the Contract Administrator on any conflicting issues between Divisions. No compensation will be made for any costs arising from conflict not identified before Work has commenced.
- .2 Coordinate the Work to be performed under this Section of the Specification with all Divisions installing equipment to ensure that there are no conflicts.
- .3 Install anchors, bolts, pipe sleeves, hanger inserts, etc. required in ample time to prevent delays to other Division's installation Work.
- .4 Lay out the Work and equipment with due regard to architectural, structural and mechanical features. Architectural and structural Drawings take precedence over electrical Drawings regarding locations of walls, doors, and equipment.
- .5 Structural members shall not be cut without prior approval of the Contract Administrator.
- .6 Examine previously constructed Work and notify the Contract Administrator of any conditions, which prejudice the proper completion of this Work.

3.3 PRODUCT HANDLING

- .1 Use all means necessary to protect the products included in this Division before, during and after installation, and to protect products and installed Work of all other trades.
- .2 Any damage to the products and/or installed Work shall be repaired or replaced by the Contractor at no additional cost to the City and to the approval of the Contract Administrator.
- .3 Remove advertising labels from all products installed that have such labels attached. Identification or CSA labels are not to be removed.
- .4 Remove dirt, rubbish, grease, etc. resulting from Work performed under this Division of the Contract from all surfaces.

3.4 SEPARATION OF SERVICES

- .1 Maintain separation between the electrical wiring system, piping, ductwork, and the instrumentation cables so that each system is isolated (except at approved connections to such systems) to prevent galvanic corrosion. In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is unacceptable.
- .2 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings are not to be used for the support of wiring.
- .3 Classifications of Circuits
 - .1 The circuit categorization shall of first priority follow Canadian Electrical Code with respect to separation for electrical safety and the following shall apply with respect to electro-magnetic compatibility:

Very Noisy	High voltage circuits and their associated grounding
	High current (>200 A) LV circuits.
	Harmonic-rich LV circuits
	DC circuits: un-suppressed or above 50 V
Noisy	Low current class two (2) circuits
	Medium power pulsed or radio frequency circuits
Indifferent	ELV digital status circuits
	Intrinsically safe circuits
	Telecommunications circuits
	Fire alarm and emergency lighting circuits (note that some fire alarm circuits may fall into the category of signal circuits).
	Any other emergency, shutdown, or high integrity circuit (e.g. toxic gas alarm).
Sensitive	Analogue signal circuits
	Data communication circuits
Very Sensitive	Low level voltage and current signals (e.g. from instrument sensors).

- .4 Separation of Circuits
 - .1 This Section relates to the running of cables carrying differing types of circuit in close proximity to one another and to other services. Sensitive circuits shall normally be run in overall shielded cable. Very sensitive circuits shall normally be run in individually twisted pair shielded cable.
 - .2 For cables sharing the same support/containment system, the following shall provide guidance to minimize extraneous interference:

Segregation between Circuits	Very Noisy	Noisy	Indifferent	Sensitive	Very Sensitive
Very Noisy	Thermal grouping as per CE Code	150 mm	300 mm	300 mm	300 mm
Noisy	150 mm	Thermal grouping as per CE Code	150 mm	150 mm	150 mm
Indifferent	300 mm	150 mm	Separation of circuit types	100 mm	100 mm
Sensitive	300 mm	150 mm	100 mm	Touching	50 mm
Very Sensitive	300 mm	150 mm	100 mm	50 mm	Touching

3.5 WIRE AND CABLE

- .1 Refer to Division 26.

3.6 CONTROL WIRING COLOUR IDENTIFICATION

- .1 Colour Codes

Conductor Purpose	Colour
Power, 120/208/240 VAC Supply	Black
Power, 120/208/240 VAC Neutral	White
Power, 24 VDC Supply (+)	Blue
Power, 24 VDC Common (-, or 0VDC)	Brown
Discrete Control AC	Red
Discrete Control DC	Blue
Intrinsically Safe	IS (light) Blue
Protective Earth (PE)	Green
Signal Ground/Instrumentation Earth (IE)	Green/Yellow

3.7 NETWORK CABLE – JACKET COLOUR

- .1 Colour Codes

Cable Purpose	Colour
Ethernet, CAT5E or CAT6	Blue
Profibus DP	Purple
Profibus PA, Non-Intrinsically Safe	Black
Profibus PA, Intrinsically Safe	Light Blue
Modbus/RTU (serial)	Grey

3.8 EQUIPMENT CONNECTIONS

- .1 Prior to the connection of signal wiring to process control and instrumentation devices, check the device voltage rating and polarity for compatibility with the

corresponding loop and/or schematic diagram. Where device and circuit characteristics are found to be incompatible, the connections are not to be made. Report the condition immediately to the Contract Administrator.

- .2 All control wiring diagrams illustrate typical control circuits applicable to the type of equipment specified. Control circuits may vary with different manufacturer's equipment. Verify all control circuits with the manufacturers of the equipment and make any corrections to the control wiring diagrams that may be required.

3.9 WIRING TO EQUIPMENT SUPPLIED BY OTHER DIVISIONS

- .1 Equipment supplied by the City or by other Divisions, that have external or field mounted control devices, are to be installed, wired and commissioned by this Division.

3.10 INSTRUMENT MOUNTING STANDS

- .1 Supply and install instrumentation mounting stands as required. Stands are to be either floor or wall mounted. The mounting stands are to be fabricated from aluminum.
- .2 Supply and install protective drip shields for any exterior stand-mounted instrumentation equipment. Drip shields are to extend 50 mm past the front and side faces of the equipment. Drip shields are to be fabricated from aluminum.

3.11 SEALING OF WALL AND FLOOR OPENINGS

- .1 Seal all conduit and cable entries passing through walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade.
- .2 Seal openings after all wiring entries have been completed.
- .3 Sealing material shall be fire resistant and shall not contain any compounds that could chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations, if required, are to be sealed. Submit shop drawing for rated assembly prior to installation of fire stop.

3.12 TAGGING STANDARDS FOR DEVICES AND WIRING

- .1 Tag all devices, wires, and I/O using the assigned loop, equipment, or device tag name. Where tag naming and numbering is not specified, the Contract Administrator will provide naming and numbering that is consistent with the plant naming conventions.

3.13 TESTING OF INSTRUMENTATION LOOPS

- .1 After all devices within a loop have been connected, check the loop for correct functioning and interaction with other loops, where applicable. Provide written notice to the Contract Administrator when the loops are going to be tested so that the tests may be witnessed at the Contract Administrator's discretion.
- .2 Check the operation of final control elements such as solenoid valves, actuators, etc. by manual control before checking with automatic control.
- .3 Check and simulate all alarms and shutdown functions.

- .4 Test all tubing for leaks in compliance with ISA RP7.1. Isolate all instruments when tubing is being tested to protect against over pressure.
- .5 Perform tests and record results on the test data forms that are included in this Section. Develop additional and/or more detailed test forms as necessary to suit more complex instrumentation.
- .6 Sign and date all test reports. Submit the test reports to the Contract Administrator within five (5) Business Days of testing.
- .7 Coordinate and cooperate with the City's staff while they verify the instrument loop I/O in the programmable logic controller (PLC) and on the supervisory control and data acquisition (SCADA) system.

3.14 CALIBRATION

- .1 Instruments are to be factory pre-calibrated. Verify calibration after installation for all instruments installed under these Specifications. Provide a printed record of the factory calibration parameters for "smart" devices.
- .2 Prior to calibration, completely program all "smart" transmitters including entries of the appropriate range and tag number. Provide a printed record of smart device serial numbers against their assigned tag number with all programmed parameters.
- .3 Calibrate all instruments to an accuracy of point five (0.5) percent of full range, or to the manufacturer's stated accuracy of the instrument whenever an accuracy of point five (0.5) percent is not achievable.
- .4 Prior to instrument installation perform the following applicable calibration for each instrument and its associated signal conditioning equipment:
 - .1 Calibrate online analyzers with known samples.

3.15 COMMISSIONING

- .1 Refer to the requirements of Division 1 for additional requirements.
- .2 Inspections
 - .1 Provide two weeks' written notice to the Contract Administrator prior to energizing any system to allow for inspection by the Contract Administrator of the following:
 - .1 Proper mounting; and,
 - .2 Proper connections.
 - .2 During Commissioning, demonstrate to the Contract Administrator proper calibration and correct operation of instruments and gauges
 - .3 Commissioning of the instrumentation and control system to include, but not be limited to, the following.
 - .1 Verify installation of components, wiring connections and piping connections.
 - .2 Supervise wiring continuity and pipe leak tests.
 - .3 Verify instrument calibration and provide written report.

- .4 Function check and adjust the instruments and control equipment under operational conditions.
- .5 Coordinate manufacturer's service personnel as required for complete system testing.
- .6 Instruct plant personnel in correct method of instruments equipment operation.
- .7 Direct plant personnel at hand-over as to final adjustment of the system for correct plant operation.
- .8 Ensure that the Manufacturer's representatives cooperate to complete the Work of this Section.
- .9 Verify signal levels and wiring connections to all instrumentation and control equipment.
- .10 Work with control system programmer to verify all field devices, wiring, calibration and operation.

3.16

TEST FORMS

Form No.	Title
.1 ITR	Instrument Test Report
.2 LCR	Loop Check Report

LOOP CHECK REPORT

- CHECKED OUT OK
- NOT APPLICABLE
- FURTHER ACTION REQUIRED

INSTRUMENT TAG NO.									
LOOP NO.									
SHEET NO.									
P & I DWG. NO.									
INSTALLATION COMPLETE									
Primary Element									
Impulse Lines									
Block and Drain Valves									
Air Supply/Filter/Reg.									
Wiring									
Tracing/Insulation/Housing									
Mounting and Location									
PLC/SCADA I/O & Status									
CALIBRATED									
Impulse Lines Press. Tested									
LOOP CHECKED									
Element To Receiver									
X Mtr. to Receiver									
X Mtr./Trans. to Receiver									
X Mtr./Trans. to Switches									
Switches to Annunciator									
Interlocking Circuit									
Controller to Valve									
Controller Action D or R									

REMARKS:

READY FOR START-UP

DATE: _____

Installed by: _____

Checked by: _____

INSTRUMENT TEST REPORT

SYSTEM: _____
 SERVICE: _____ TAG NO. _____
 LOCATION: _____
 MAKE: _____ MODEL: _____
 SERIAL NO.: _____ CSA: _____
 ELEMENT: _____ RANGE: _____
 DESIGN SETTING/RANGE: _____ CONTACT TO: _____ ON: _____
 SIGNAL IN: _____ OUT: _____ ASSOCIATED INSTRUMENT: _____
 INSTRUMENT CONDITION: _____ CONFORM TO SPEC: _____
 PROJECT NO.: _____ DATA SHEET: _____

	TEST 1				TEST 2			
TEST METHOD								
	INPUT		OUTPUT		INPUT		OUTPUT	
PROCESS	INC.	DEC.	INC.	DEC.	INC.	DEC.	INC.	DEC.
TEST POINT 1								
TEST POINT 2								
TEST POINT 3								
TEST POINT 4								
TEST POINT 5								
COMMENTS								
GRAPHS								

TESTED BY: _____ CHECKED BY: _____
 DATE: _____ DATE: _____

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

- .1 Suppliers, Equipment, Products, and Execution must meet all requirements detailed in Section 29 05 00 – Common Work Instrumentation.
- .2 Local control stations shall be supplied to house local control switches, push buttons and indicator lights associated with field devices (valves, drives etc.). The control stations shall be located in close proximity to their associated devices. Where a group of devices are located within close proximity to each other, the local controls may be combined into a single common local control panel. Line of site must be maintained between all devices and the respective local controls.

Part 2 Products

2.1 GENERAL

- .1 Unless otherwise specified, provide outside finishes on all enclosures in ANSI 61 Grey.
- .2 The enclosures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors without any warpage.

2.2 ENCLOSURES

- .1 Provide Electrical EEMAC Type 12 enclosures for ordinary locations.

2.3 WIRING AND ACCESSORIES

- .1 Provide wiring inside the enclosures according to the following Specifications:
 - .1 Control wiring to be a minimum of #16 AWG tinned stranded copper; insulation rated at 600 V.
 - .2 Wiring for power distribution shall be a minimum of #14 AWG tinned stranded copper; insulation rated at 600 V.
 - .3 Install cables in accordance with the requirements of Division 26.
- .2 Tag each wire at both ends with a heat shrink sleeve that is machine printed. Allow approximately 20 mm of wire insulation between the tag and the bare wire.
- .3 Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes.
- .4 Run all wiring in enclosed plastic wireways such as Panduit. Size all wireways so that the total cross sectional area of the insulated wire and cable does not exceed 40 percent of the cross sectional area of the wire way.
- .5 Provide a minimum clearance of 50 mm between wire ways and any point of wire termination.
- .6 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the enclosure. Identify each terminal strip with a terminal strip number, defined as follows:

- .1 Wire identification to use the connected field device tag name with the wire's corresponding end device terminal number appended to it.
- .2 Identify every joint and/or terminal of the above wire run with the same identifier until the wire meets another tagged device, at which point the wire identifier will change to use the new device name and terminal number.
- .3 For example, pressure transmitter FIT-740 located in the field has a 1 PR-TPSH cable connected to it. The cable runs through a junction box to a marshaling panel. The wire identifiers for the pair of wires would be FIT-740 all the way to the marshaling panel.
- .4 Identify spare wires by using the cable tag, wire number and an "-SP" suffix.
- .5 Arrange wiring on terminal blocks such that all internal panel wiring terminates on the inboard side of the terminal blocks and all external wiring terminates on the outboard side.
- .7 Provide sufficient terminals so that not more than two wires are connected under the same terminal. Provide twenty (20) percent spare terminal capacity at each terminal block assembly.
- .8 Terminals shall be Weidmuller W Series color coded as follows:
 - Red = positive 24 VDC
 - Black = analog signal plus
 - White = analog signal common and VAC neutral
 - Grey = 120 VAC
 - Green = ground
- .9 Provide nameplates for each device on or within the panels and enclosures. Nameplates shall be white lamicaid with black lettering, a minimum of 25 mm x 75 mm in size with up to three lines of 5 mm lettering. Securely fasten nameplates in and situate them in a visible location.

2.4 PANEL GROUNDING

- .1 Provide a ground system for the instrumentation circuits.
- .2 Provide grounding lugs for each panel, suitable for termination of up to #2 AWG copper grounding conductor.
- .3 Firmly bond all panel-mounted devices on or within the panels to ground. Provide supplementary bonding conductors for back panels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

Part 3 Execution

3.1 MOUNTING HEIGHTS

- .1 Unless otherwise specified or a conflict exists, mount all panels, starters and disconnects 2000 mm to top of cover.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No. 214, Communications Cables (Bi-National standard with UL 444).
 - .2 CSA-C22.2 No. 232, Optical Fiber Cables.
- .2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
 - .1 TIA/EIA-568-B.1, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
 - .2 TIA/EIA-568-B.2, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
 - .3 TIA/EIA-568-B.3, Optical Fiber Cabling Components Standard.
 - .4 TIA/EIA-606-A, Administration Standard for the Commercial Telecommunications Infrastructure.
 - .5 TIA TSB-140, Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.
 - .6 TIA-598-C, Optical Fiber Cable Color Coding.

1.2 DEFINITIONS

- .1 Refer to TIA/EIA-598-C, Annex A for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Division 26.

1.4 RELATED WORK

- .1 Refer to Division 26.

1.5 INSPECTION

- .1 Provide adequate notice to the Contract Administrator so that all cable installations can be inspected prior to energizing equipment.

1.6 STANDARDS

- .1 All wire and cable shall be CSA approved.

Part 2 Products**2.1 TWISTED PAIR SHIELDED CABLES (TPSH)**

- .1 TPSH shall be constructed as follows:

- .1 Two (2) copper conductors, stranded, minimum #18 AWG, PVC insulated, twisted in nominal intervals of 50 mm.
 - .2 Insulated for 600 V, ninety (90) degrees Celsius.
 - .3 100% coverage aluminum foil or tape shield.
 - .4 Separate bare stranded copper drain wire, minimum #18 AWG.
 - .5 Overall flame retardant PVC jacket to CSA-C22.2.
 - .6 The entire cable assembly to be suitable for pulling in conduit or laying in cable tray.
 - .7 Interlocked aluminum armour and outer PVC jacket.
 - .8 Shaw Type 1751-CSA or Beldon equivalent.
- .2 Where multi-conductor TPSH cables are called for, each pair shall be individually shielded, continuous number coded, and the cable assembly shall have an overall shield and overall flame retardant PVC jacket.

2.2 RTD AND MULTI CONDUCTOR SHIELDED CABLE

- .1 RTD cables shall be CSA approved and shall be constructed as follows:
- .1 Three (3) or more copper conductors, stranded, minimum # 18 AWG.
 - .2 PVC insulated for 600 V.
 - .3 One hundred (10) percent coverage aluminum foil or tape shield.
 - .4 Separate bare stranded copper drain wire.
 - .5 Interlocked aluminum armour and outer PVC jacket.
 - .6 Overall flame retardant PVC jacket to CSA-C22.2.

2.3 TECK CABLES

- .1 As per Division 26.

2.4 WIRE

- .1 As per Division 26.

2.5 100 BASE TX CATEGORY 6 COMMUNICATION CABLE

- .1 Category 6 cable shall be CSA approved and constructed as follows:
- .1 Four (4) bonded pairs, solid stranded, #24 AWG.
 - .2 Interlocked aluminum armour.
 - .3 Rip cord.
 - .4 PVC inner and outer jackets.
 - .5 UL verified to Category 6.
 - .6 Insulated for 300 V.
 - .7 Shielded

Part 3 Execution**3.1 ANALOG SIGNALS**

- .1 Use TPSH cable for all low level analog signals such as 4-20 mA, pulse type circuits 24 VDC and under, and other signals of a similar nature.
- .2 Use RTD cable for connections between RTDs and transmitters or control system RTD inputs.

3.2 DIGITAL SIGNALS

- .1 Use TPSH cable for all low level input (24 V and below) and output signals to the control system.

3.3 INSTRUMENT POWER

- .1 Use Teck cable or wire and conduit for power to instruments, for 120 V signals other than those mentioned above and as otherwise indicated on the Drawings. Use stranded wire and cable to supply power to instruments.

3.4 INSTALLATION

- .1 Install instrumentation cables in cable trays. Use a minimum of 300 mm and a maximum of 1000 mm length of liquid tight flexible conduit to connect the field sensors to the conduit.
- .2 Where instrumentation cables are installed in cable trays, provide barriers in the tray to separate instrumentation cables from power cables.
- .3 At each end of the run leave sufficient cable length for termination.
- .4 Do not make splices in any of the instrumentation cable runs.
- .5 Cable shields shall be terminated on insulated terminals and carried through to the extent of the cable.
- .6 Ground cable shields at one (1) end only. Unless otherwise specified, ground the shields at the PLC control panel.
- .7 Protect all conductors against moisture during and after installation.

3.5 CAT 6 INSTALLATION:

- .1 Always follow the Manufacturer's guidelines for minimum bend radius and tension.
- .2 All installations and terminations shall be performed by personnel experienced in Cat 6 cable installation.
- .3 Perform cable testing with time domain reflectometer instrument and provide complete detailed test report. Test all runs upon completion of permanent terminations, using instrumentation acceptable to Contract Administrator. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.
 - .1 Test for the following:
 - .1 Continuity.
 - .2 Pair placement and polarity.
 - .3 DC resistance.

- .4 Characteristics at highest contemplated frequency:
 - .1 Attenuation - data cable.
 - .2 Mutual Capacitance - data cable.
 - .3 Near-end crosstalk (NEXT) - data cable.
- .5 Run length.
- .2 Category 6 using certified level III tester to: TIA/EIA-568-B.2.
- .3 Reconnect or re-install and retest as necessary to correct excessive variations.

3.6 FIELD QUALITY CONTROL

- .1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as hard copy.
 - .1 Perform tests for Permanent Link on installed cables, including spares:
 - .1 Category 6 using certified level III tester to: TIA/EIA-568-B.2.
 - .2 Perform tests for Channel on one hundred (100) percent of cross-connected data horizontal cabling installed from each telecommunications room, including shortest and longest drops from each telecommunications room.
 - .1 Category 6 using certified level III tester to: TIA/EIA-568-B.

3.7 CONDUCTOR TERMINATIONS

- .1 All equipment supplied shall be equipped with terminal blocks to accept conductor connections.
- .2 Instrumentation conductors, where terminated at equipment terminals other than clamping type terminal blocks, shall be equipped with Burndy-YAE-2 or STA-KON, self-insulated, locking type terminators, sized as required to fit conductors and screw terminals.

3.8 TESTING

- .1 Test all conductors for opens, shorts, or grounds. Resistance values shall not be less than those recommended by the cable manufacturer.

3.9 IDENTIFICATION

- .1 Identify all instrumentation cables.
- .2 Identify each conductor with wire numbers using a machine printed Raychem TMS heat shrink wire marker or approved equal in accordance with B6 of the Bid Opportunity.

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

- .1 Equipment, Products and Execution must meet all requirements detailed in Section 29 05 00 – Common Work Instrumentation.

Part 2 Products

2.1 MISCELLANEOUS PANEL DEVICES

- .1 Ethernet Switch
 - .1 Install Ethernet switch in RTU control panel
 - .2 Eight (8) port Ethernet switch
 - .3 Two (2) 100 FX multimode ST connectors
 - .4 Power Supply: 24 VDC
 - .5 Mounting: DIN rail
 - .6 Approved Product: Ruggedcom RS900
- .2 Pilot Lights
 - .1 Provide LED transformer type pilot lights for extended lamp life, oil tight, push to test, complete with appropriate colour lenses. Normal colours used are run = red, stop = green, fault = amber. Refer to Division 26 for additional information.
- .3 Terminals
 - .1 Provide strap screw type terminal blocks rated for 600 V.
 - .2 Identify each terminal block within an enclosure with a unique machine printed terminal block number. Cabinet chassis grounding terminal blocks to be identified by the electrical ground symbol.
 - .3 Connections to screw terminals to be locking fork tongue insulated crimp type wire connectors.
 - .4 Terminals to be Weidmuller or approved equal.
 - .5 Provide a group of terminals for each of 120 VAC hot and neutral and 24 VDC positive and negative power. Distribution wiring to have a thermal magnetic circuit breaker upstream of all major blocks of loads, adequately sized to protect the connected load while not causing nuisance tripping.
 - .6 Provide Weidmuller disconnect type terminal blocks for each load or loop powered from the marshalling panels.
- .4 Nameplates
 - .1 Refer to Section 29 05 00 - Common Work Instrumentation.

Part 3 Execution

3.1 REFERENCES - GENERAL

- .1 Refer to Section 29 05 00 - Common Work Instrumentation.

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

- .1 Refer to Section 29 05 00 – Common Work – Instrumentation and Controls.

Part 2 Products

2.1 POWER SUPPLY AND CONDITIONING EQUIPMENT

.1 General

- .1 Provide all DC power supplies as required for all instrument circuits. All circuits are to be powered from the PLC control panels. Power supplies to be Hammond, G.F.C., Weidmuller or approved equal, complete with an over-voltage protection module.
- .2 DC power supplies shall be fully redundant. Individual fault signals from each power supply shall be monitored by the PLC for alarming.
- .3 Unless otherwise required, all DC power supplies to be rated 28 VDC, adjustable plus or minus five (5) percent, and set to provide 26.4 V on the panel direct current bus. Size the power supply for two (2) times the connected load, minimum size is 2 amps.

2.2 NOISE SUPPRESSION

- .1 Provide TVSS units in each panel to power AC I&C loads. Power conditioners are to be SquareD, Cutler Hammer, Leviton.

2.3 UPS POWER SUPPLY

- .1 Provide 120 VAC UPS power in each control panel: UPS power for critical loads and non-UPS power for non-critical loads.
- .2 Control and operator interface system hardware including but not limited to programmable logic controllers (PLCs), PLC I/O racks, PLC communication modules, wireless radios, auto dialers, and industrial network switches shall be powered from the UPS.
- .3 VAC instrument power, non-critical loads include control panel interior lights and receptacles shall be powered from the non-UPS power.
- .4 Provide the total expected critical and non-critical loads fed from each control panel as a Shop Drawing submittal so that the external power sources and UPS can be properly sized.
- .5 Mount UPS control panel.
- .6 Provide plug and cap wiring to allow for by-passing the UPS.
- .7 Batteries sized for fifteen (15) minutes of runtime.
- .8 UPS: Eaton PW9130.

Part 3 Execution

3.1 REFERENCES - GENERAL

- .1 Refer to Section 29 05 00 - Common Work - Instrumentation and Controls,
Part 3.

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

- .1 Refer to Section 29 05 00 – Common Work Instrumentation.

1.2 RTU I/O INDEX

- .1 The following spreadsheet gives an itemized list of the new Remote Terminal Unit (RUT) System inputs and outputs. It is intended to serve as an aid for determining the cabling requirements for the Work specified in this Division.

Part 2 Products

- .1 Not used

Part 3 Execution

- .1 Not used

END OF SECTION

RTU I/O INDEX

RECORD NO.	REV. NO.	TAG NAME	DESCRIPTION		P&ID DRAWING	I/O SPECIFICATION										
						ENG. UNITS	SCALE		ALARMS		RTU CABINET	I/O TYPE	I/O ADDRESS	I/O EXPANSION CARD	I/O TERMINAL BLOCK	I/O POINT
							LOW	HIGH	LOW	HIGH						
0001	0	0801-JA-001	Power Fail Alarm	120 VAC Power						On	RTU-0801	DI	10001	0	P7	0
0002	0	0801-JA-002-A	Power Fail Alarm	24 VDC Power Supply 1						On	RTU-0801	DI	10002	0	P7	1
0003	0	0801-JA-002-B	Power Fail Alarm	24 VDC Power Supply 2						On	RTU-0801	DI	10003	0	P7	2
0004	0	0801-LA-003	Flood Switch	Building Basement						On	RTU-0801	DI	10004	0	P7	3
0005	0	0801-ZA-005	Security Alarm	Building Security System						On	RTU-0801	DI	10005	0	P7	4
0006	0	0801-HS-007	Station Lockout	Station Lockout						On	RTU-0801	DI	10006	0	P7	5
0007	0		Spare								RTU-0801	DI	10007	0	P7	6
0008	0		Spare								RTU-0801	DI	10008	0	P7	7
0009	0	0801-TI-004	Temperature Transmitter	Space Temperature		C	-10	40	4	N/A	RTU-0801	AI	40001	0	P4	0
0010	0	0801-FI-008	Flow Transmitter	Discharge Flow - 100mm Camlock						N/A	RTU-0801	AI	40002	0	P4	1
0011	0	0801-FI-009	Flow Transmitter	Discharge Flow - 100mm Camlock						N/A	RTU-0801	AI	40003	0	P4	2
0012	0	0801-PI-010	Pressure Transmitter	Service Main		kPa	0	1000	100	800	RTU-0801	AI	40004	0	P4	3
0013	0		Spare								RTU-0801	AI	40005	0	P4	4
0014	0		Spare								RTU-0801	AI	40006	0	P4	5
0015	0		Spare								RTU-0801	AI	40007	0	P4	6
0016	0		Spare								RTU-0801	AI	40008	0	P4	7

Part 1 General

1.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00 – Common Work Instrumentation.

1.2 INSTRUMENT INDEX

.1 The following spreadsheet gives an itemized list of the instrumentation included as part of this Work.

Part 2 Products

.1 Not used

Part 3 Execution

.1 Not used

END OF SECTION

INSTRUMENTATION INDEX

RECOR D NO.	REV. NO.	TAG NAME	INSTRUMENT TYPE	SERVICE	POWER SUPPLY	CALIBRATED RANGE	MOUNTING	SUPPLIED BY	INSTALLED BY	COMMENTS	SPEC. DATA SHEET	P&ID DRAWING
0001	0	0801-LA-003	Level Switch	Building Flood	24 VDC		Suspended	Contractor	Contractor		I-103	
0002	0	0801-TIT-004	Temperature Transmitter	Building Space	24 VDC	-10 to 40°C	Wall	Contractor	Contractor		I-104	
0003	0	0801-FIT-008	Magnetic Flow Transmitter	Discharge Flow - 100mm Camlock	24 VDC	0 to 50 L/sec	Flange	Existing		Provide new cabling and connection to RTU	I-101	
0004	0	0801-FIT-009	Magnetic Flow Transmitter	Discharge Flow - 100mm Camlock	24 VDC	0 to 50 L/sec	Flange	Existing		Provide new cabling and connection to RTU	I-101	
0005	0	0801-PIT-010	Pressure Transmitter	Service Main	24 VDC	0 to 1000 kPs	25 mm NPT	Contractor	Contractor		I-102	

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Supply and install Remote Terminal Unit (RTU) based control panels for the pumping system, and building monitoring.
 - .1 Coordinate and cooperate with other Contractors, suppliers, and the City's Representatives during system programming, start-up, and commissioning of the complete control system and associated field devices and wiring.
 - .2 Provide complete RTU and operator graphic interface programming, start-up and commissioning.

Part 2 Products

2.1 REMOTE TERMINAL UNITS

- .1 General
 - .1 Wall mounted NEMA 12 enclosures.
 - .2 Cable entry via bottom.
 - .3 Terminate all field wiring on terminal blocks in RTU control panels.
 - .4 Provide fused terminal blocks for all field power sourced from the control panel.
- .2 RTU Processor
 - .1 Approved Product: Schneider Electric Scadapack 357E.
- .3 RTU Expansion I/O Hardware
 - .1 Approved Product: Schneider Electric Scadapack E 5606.
- .4 Power Supply
 - .1 Panel shall contain 24VDC power supply.
 - .2 Panel shall accept a single 120VAC, 15amp circuit and a 120 VAC UPS circuit.
 - .3 Panel door shall have a Green "Power On" lights for normal 120 VAC and UPS 120 VAC power.

2.2 PROGRAMMING

- .1 Document all programming logic.
- .2 Provide the RTU programs and the operator interface program to the City after the completion of the commissioning.

Part 3 Execution

3.1 INSTALLATION

- .1 Install the hardware in accordance with the foregoing requirements to satisfy the performance requirements defined in this and other Divisions of the Specification.
- .2 Cooperate with other contractors, suppliers, the City and the Contract Administrator to commission and start-up the system as defined herein.

END OF SECTION

Part 1. General

1.1 REFERENCES - GENERAL

- .1 The Work includes the provision of all instrument specification sheets.
- .2 Refer to Section 29 05 00.

1.2 INSTRUMENT SPECIFICATION SHEETS

- .1 Provide data sheets to itemize detailed as-built information regarding the Specification of instruments included as part of this Work for each instrument supplied. The data sheets already included in this Section list specific minimum requirements for particular applications.
- .2 Use forms in accordance with the ISA Standard S20 as a template for the preparation of the specification sheets.

Part 2. Products

- .1 Refer to the following specification sheets.

INSTRUMENT

SPECIFICATION NUMBER:	I-101
DEVICE:	Flow Meter
TAG:	Refer to Instrument Index, Section 29 40 21
TYPE:	Magnetic Flow Meter
SERVICE:	Potable Water
SIZE AND MATERIAL:	Size as per P&IDs
END CONNECTIONS:	Flanged
LINER MATERIAL:	PFA
ELECTRODES:	Stainless Steel
GROUNDING:	Stainless Steel grounding rings
RANGE:	Refer to Instrument Index, Section 29 40 21
INACCURACY:	±0.2% for flows greater than 0.3 m per second
OUTPUT:	4 to 20 mADC into 500 ohm load Scaled pulse output
POWER SUPPLY:	120 VAC, 60 Hz
INDICATION:	Local indication of flow rate and totalized flow
ELECTRONIC ENCLOSURE:	NEMA 4X. Integral transmitter. Remote wall-mount transmitter when flow tube is more than 1.5m AFF.
MANUFACTURER AND MODEL:	City Supplied.

INSTRUMENT

SPECIFICATION NUMBER: I-102

DEVICE: Pressure Transmitter

TAG: Refer to Instrument Index, **Section 29 40 21**

SERVICE: Potable Water

PROCESS CONNECTIONS: 0.50 inch NPTF

RANGE: Refer to Instrument Index, **Section 29 40 21**

INACCURACY: ±1% of span or lower

OUTPUT: 4 to 20 mA DC into 500 OHM load

POWER SUPPLY: Loop powered 24 VDC

CONSTRUCTION: 316 SST

ELECTRONIC ENCLOSURE: EEMAC/NEMA 4X

LOCAL DISPLAY: Unit mounted LCD Display

ACCESSORIES: Block & bleed manifold

MANUFACTURER AND MODEL: Siemens

INSTRUMENT

SPECIFICATION NUMBER: I-103

DEVICE: Float Switch

TAG: Refer to Instrument Index, **Section 29 40 21**

SERVICE: Refer to Instrument Index and P&ID Diagrams

OUTPUT: SPDT Contacts

ENCLOSURE: Polypropylene float casing with pre-terminated signal cable

MOUNTING: Provide strain relief-type connectors to suspend float at desired location. Fabricate mounting brackets from 316 SS. Provide anti-sway rings to prevent sway in turbulent tanks.

MANUFACTURER AND MODEL: Flygt ENM-10

**INSTRUMENT
SPECIFICATION NUMBER: I-104**

DEVICE: Temperature

TAG: Refer to Instrument Index, **Section 29 40 21**

SERVICE: Space temperature

SPAN: -10 to 40°C

SENSOR: 3 wire RTD, PT 100

INACCURACY: ±0.1% of span

OUTPUT: 4 to 20 mA DC into 500 OHM

POWER SUPPLY: Loop powered 24 VDC

CONSTRUCTION: Stainless steel wetted parts

ELECTRONIC ENCLOSURE: Universal head, aluminum alloy

LOCAL DISPLAY: Head mounted LCD Display

ACCESSORIES: Mounting bracket

MANUFACTURER AND MODEL: Siemens

END OF SECTION