Part 1 General

1.1 MINIMUM STANDARDS

.1 Execute Work to meet or exceed the latest edition of:

.1 Manitoba Building Code, including all amendments up to project date.
.2 Rules and regulations of authorities having jurisdiction (AHJ).
.3 Occupational Health and Safety Act,
.4 Canadian Construction Safety Code,
.5 Contract documents.
.6 Workplace Safety and Health;
.7 Canadian Electrical Code;

1.2 STORAGE OF EQUIPMENT AND MATERIALS

.1 Contractor to co-ordinate with the Contract Administrator.

1.3 FEES, PERMITS AND CERTIFICATES

.1 Provide authorities having jurisdiction with information requested.

.2 Pay fees and obtain certificates and permits required.

.3 Furnish certificates and permits when requested.

1.4 DOCUMENTS

.1 Keep on copy of contract documents and shop drawings on the site.

1.5 AS-BUILT RECORD DRAWINGS

.1 As Work progresses and as required, record significant deviations from the Contract drawings. Prior to Preliminary Acceptance, submit one copy of As-Constructed drawings to Contract Administrator. Refer to sections 01 33 00 – Submittal Procedures and 01 78 00 – Closeout Submittals.

1.6 MATERIAL AND EQUIPMENT

.1 Use new products unless otherwise specified.

.2 Deliver and store material and equipment to manufacturer’s instructions with manufacturer’s labels and seals intact.

1.7 CUTTING AND REMEDIAL WORK

.1 Coordinate Work to keep cutting and remedial Work to a minimum.

1.8 FASTENINGS

.1 Provide fastenings of type, size and spacing required to assure secure anchorage.

.2 Obtain Contract Administrator’s approval before using explosive actuated fasteners.

1.9 CONSTRUCTION TIME AND SCHEDULING

.1 In conjunction with and in form acceptable to Contract Administrator provide within 10 working days after contract award, schedule showing dates for:

- Submission of shop drawings, material tests and samples.
- Delivery of equipment and materials.
- Commencement and completion of Work of each major component of the Work.
- Final completion date within time period required by contract documents.

1.10 SUPERVISION

.1 Provide the necessary supervision and qualified tradesmen to ensure that flow of materials and on-site installation compatible with the overall project schedule and progress.

1.11 CONTRACTOR'S USE OF PREMISES

.1 The Contract Administrator will define the Contractor's use of the premises.

.2 Make arrangements with the Contract Administrator if additional areas are required. Obtain written agreements and submit copies to Contract Administrator.

.3 Confine operations within easements for construction, storage and access as shown on Contract Drawings.

.4 Service shutdowns that impact the normal operation of the facility is not permitted unless approved otherwise in writing by the Contract Administrator. Detailed shutdown plans shall be prepared by the Contractor in coordination with the Contract Administrator for any service shutdown ensuring backup services are available to service the facility during the shutdown period (Ex. Natural gas shutdown will require all existing boiler to be operated on digester gas). Operation of the redundant systems at all times are required for the operation of this facility. Therefore, unavailability of redundant systems must be limited to no more than single shift. Backup plans must be set in place during a shutdown to quickly restore the redundant service, should the operating service fails. The dates of shutdowns shall be co-ordinated with and approved by the Contract Administrator. The dates must be submitted minimum of four (4) weeks prior to before the proposed shutdown for approval.

.5 Protect landscaping from damage due to construction activities. Restore any damages caused by construction activities to original condition.

1.12 QUALITY CONTROL

.1 Adhere to manufacturer's recommendations with respect to handling, preparation, installation, testing, operation or protection of any product or material to be incorporated in Work.

.2 Ensure that all materials supplied are compatible with each other unless specific adjacent materials have been specified. Correct any defective Work caused by non-compatibility of materials.

.3 Where practical or desirable, tests will be conducted by Contract Administrator on materials and equipment to be incorporated into permanent Works before delivery to site.

.4 Submit to Contract Administrator full information on materials, equipment and related arrangements to be furnished.

.5 Submit information in a form approved by Contract Administrator

.6 Submit sufficient information to enable Contract Administrator to determine whether proposed materials, equipment, and arrangements meet contract requirements.

1.13 PROJECT MEETINGS

1. Project meetings will be held on weekly basis at times and locations approved by the Contract Administrator.

1.14 DEMONSTRATION AND TRAINING

.1 Provide training as per Section 01 79 00 – Demonstration and Training.

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 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 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable. Review submittals prior to submission to Contract Administrator. This review represents that necessary requirement 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.

.5 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.6 Verify field measurements and affected adjacent Work are co-ordinated.

.7 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.

.8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.

.9 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.3 Allow **10 working days** for Contract Administrator's review of each submission.

.4 Adjustments made on shop drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.

.5 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.

.6 Accompany submissions with transmittal letter, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.7 Submissions include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

- Subcontractor.
- Supplier.
- Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

- Fabrication.
- Layout, showing dimensions, including identified field dimensions, and clearances.
- Setting or erection details.
- Capacities.
- Performance characteristics.
- Standards.
- Operating weight.
- Wiring diagrams.
- Single line and schematic diagrams.
- Relationship to adjacent Work.

.8 After Contract Administrator's review, distribute copies.

.9 Submit electronic (PDF format) copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.

.10 Submit electronic (PDF format) copies 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.

.11 Submit electronic (PDF format) copies 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.

.12 Submit one electronic PDF copy and 3 hard copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.

.13 Delete information not applicable to project.

.14 Supplement standard information to provide details applicable to project.

.15 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be stamped and returned, and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.1 Shop Drawing Review Stamp:

.1 ***No Comment:*** There are no further comments and Work may proceed on the basis of submitted shop drawing.

.2 ***Amend As Noted:*** The Contractor shall amend the shop drawing as noted by the Contract Administrator and proceed with the work. Re-submission of the shop drawing is not required. (The amended shop drawing shall be included in the close-out documents.)

.3 ***Amend and Re-submit:*** The shop drawing shall be amended based on Contract Administrator's comments and re-submitted for further review.

.4 ***Rejected:*** The shop drawing does not comply with contract requirements and therefore not accepted. A separate shop drawing with the products that comply with the contract shall be submitted.

1.3 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement and as directed by Contract Administrator.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Frequency of photographic documentation: weekly.

.1 Upon completion of: excavation, foundation, framing and services before concealment, and as directed by Contract Administrator.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

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

.2 Province of Manitoba

.1 The Workers Compensation Act RSM 1987 - Updated 2006.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Refer to Clause D12 - Safe Work Plan, in Part D – Supplemental Conditions.

.3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.4 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 SAFETY ASSESSMENT

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

1.4 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

1.5 RESPONSIBILITY

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

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

1.6 COMPLIANCE REQUIREMENTS

.1 Comply with The Workers Compensation Act, Workplace Safety Regulation.
.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.7 UNFORESEEN HAZARDS

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

1.8 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have working knowledge of occupational safety and health regulations.

.2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

1.9 POSTING OF DOCUMENTS

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

1.10 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction.

1.11 WORK STOPPAGE

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 INSPECTION

.1 Allow Contract Administrator access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Contract Administrator instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Contract Administrator will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such Work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Contract Administrator shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Contract Administrator for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Contract Administrator.

.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, the 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.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

.1 Notify appropriate agency and 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.

1.5 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's Work damaged by such removals or replacements promptly.

.3 If in opinion of Contract Administrator, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Contract Administrator will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents.

1.6 REPORTS

.1 Submit electronic copy 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.

1.7 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.

1.8 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.

.2 Construct in locations acceptable to Contract Administrator.

.3 Prepare mock-ups for Contract Administrator review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups 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.

.5 If requested, Contract Administrator will assist in preparing schedule fixing dates for preparation.

.6 Remove mock-up when acceptable to Contract Administrator.

.7 Mock-ups may remain as part of Work when acceptable to Contract Administrator.

.8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.9 MILL TESTS

.1 Submit mill test certificates as required of specification Sections or requested by Contract Administrator.

1.10 EQUIPMENT AND SYSTEMS

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 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 and ventilation as required during construction period, including attendance, maintenance and fuel.

1.4 TEMPORARY POWER AND LIGHT

.1 Contractor is responsible for all power and lighting required during construction.

.2 Provide and maintain temporary lighting throughout project.

1.5 TEMPORARY COMMUNICATION FACILITIES

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

1.6 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes and regulations.

.2 Burning rubbish and construction waste materials is not permitted on site.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Provide construction facilities as specified herein.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.189-[00], Exterior Alkyd Primer for Wood.

.2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-0121-M1978(R2003), Douglas Fir Plywood.

.3 CAN/CSA-S269.2-M1987(R2003, Access Scaffolding for Construction Purposes.

.4 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 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 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute Work expeditiously.

.5 Remove from site all such Work after use.

1.5 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, platforms, ladders, and temporary stairs.

1.6 HOISTING

.1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists to be operated by qualified operator.

1.7 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.

.3 New equipment and materials shall not be stored outside exposed to weather conditions.

1.8 CONSTRUCTION PARKING

.1 Parking will be permitted on site in an area designated by the Contract Administrator provided it does not disrupt performance of the City's normal operations. Additional parking above and beyond amount available in the designated area is the responsibility of the Contractor.

.2 Provide and maintain adequate access to project site.

1.9 SECURITY

.1 Construction site security, including laydown areas, is the responsibility of the contractor.

.2 The Contractor may hire security staff at their discretion. The Contractor must receive approval from the City prior to hiring 24-hour security staff for their laydown area.

1.10 OFFICES

.1 Contractor may provide an office trailer within the designated laydown area at their discretion.

.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.

1.11 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.

1.12 SANITARY FACILITIES

.1 Provide sanitary facilities for workforce in accordance with governing regulations and ordinances. Locate in area(s) designated by Contract Administrator.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

.3 Contractor shall not use any the exiting sanitary facilities within the buildings of NEWPCC Site.

1.13 CONSTRUCTION SIGNAGE

.1 No other signs or advertisements, other than warning signs, are permitted on site.
.2 Graphic symbols to CAN/CSA-Z321.
.3 Maintain approved signs and notices in good condition for duration of project and dispose of off site on completion of project or earlier if directed by Contract Administrator.

1.14 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.2 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.3 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

1.15 CLEAN-UP

.1 Work areas shall be cleaned daily. Incorporate effective dust control measures to keep the piping and pipe wrap in clean condition.

.2 Remove construction debris, waste materials, packaging material from worksite daily.

.3 Clean dirt or mud tracked into facility immediately.

.4 Store materials resulting from demolition activities that are salvageable in designated areas.

.5 Stack stored new or salvaged material not in construction facilities.

.6 Snow clearing of the construction site and site access as and when required is the responsibility of the 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 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.

.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 Provide and use marked separate bins for recycling.

.7 Dispose of waste materials and debris off site.

.8 Clean interior areas prior to start of finishing Work and maintain areas free of dust and other contaminants during finishing operations.

.9 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

.1 Provide final cleaning per following as applicable to this project:

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Contract Administrator. Do not burn waste materials on site.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.8 Remove stains, spots, marks and dirt from decorative Work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

.17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.18 Clean roofs, downspouts, and drainage systems.

.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to building.

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 SECTION INCLUDES

.1 Text, schedules and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects.

1.2 INTENT

.1 Minimize the amount of non-hazardous solid waste generated and maximize the reduction, reuse, and recycling of solid waste produced by this Work.

.2 Furnish all labour and equipment to collect, remove and dispose of all waste materials found on site prior to commencing Work and/or generated as a result of operations during any phase of construction.

.3 Respect environmental regulations and prevent environmental pollution damage.

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

1.4 DEFINITIONS

.1 **Recyclable:** Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.

.2 **Recycle:** Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.3 **Recycling:** Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.4 **Reuse:** Repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.5 **Salvaging**: reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.6 **Returning**: reusable items including pallets or unused products to vendors.

.7 **Salvage:** Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.8 **Source Separation:** Acts of keeping different types of waste materials separate beginning from first time they became waste.

1.5 STORAGE, HANDLING AND PROTECTION

.1 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.

.2 Store, materials to be reused, recycled and salvaged in locations as directed by Waste Management Coordinator.

.3 Unless specified otherwise, materials for removal become Contractor's property.

.4 Protect, stockpile, store and catalogue salvaged items.

.5 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.6 Protect surface drainage, mechanical and electrical from damage and blockage.

.7 Separate and store materials produced during dismantling of structures in designated areas.

.8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.9 Separate and store materials produced during project in designated areas.

.10 Remove co-mingled materials to off-site processing facility for separation.

.11 Provide waybills for separated materials removed from site.

.12 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.6 WASTE DISPOSAL

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of liquid waste into waterways, storm, or sanitary sewers.

.3 Keep records of construction waste including:

- .1 Number and size of bins.
- .2 Waste type of each bin.
- .3 Total tonnage generated.
- .4 Tonnage reused or recycled.
- .5 Reused or recycled waste destination.
- .6 Weigh bills from all waste and recycling destinations

.4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

.6 Consult with and obtain approval of Contract Administrator before removing waste materials.

.7 Dispose of materials unsuitable for reuse at option of Contractor, by means and at locations of choice. Upon approval of Contract Administrator, disposal areas may be located near building site.

.8 Trim stockpiles and waste to neat and presentable appearance.

.6 Take every precaution not to damage adjacent building finishes, or overhead or underground utilities. Retain liability for repair of damages occurring in performance of Work.

1.7 USE OF SITE AND FACILITIES

.1 Execute Work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility.

1.8 SCHEDULING

.1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Where Work includes handling, hauling and disposing of environmentally sensitive (containment/pollutant), or hazardous materials, so such Work and locate waste or disposal areas to requirements, standards and approval of Manitoba Environment and Workplace Safety and Health, and all applicable regulations.

Part 2 PRODUCTS

2.1 NOT USED

Not Used.

Part 3 EXECUTION

3.1 APPLICATION

.1 Handle waste materials not reused, salvaged, or recycled, in accordance with all appropriate regulations and codes.

3.2 CLEANING

.1 Clean the Place of Work regularly. Leave areas clean at the end of each day.

.2 Perform final cleaning at project completion and remove surplus waste, materials, rubbish, tools, and equipment in accordance with Section 01 74 11 - Cleaning and as follows:

.3 Remove recycling containers and bins from site and dispose of materials at appropriate facilities.

.4 Separate materials to be reused/recycled into specific collection bins.

3.3 DIVERSION OF MATERIALS

.1 From following list below, separate waste materials into separate piles or containers as coordinated by the Waste Management Coordinator, and in compliance with applicable fire regulations.

.2 Clearly label containers or stockpiles for each type of material.

.3 Provide instruction on disposal practices.

.4 On-site sale of materials is not permitted unless approved by Contract Administrator.

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 with Contract Administrator's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three 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: provide title of project; Date of submission; names.

.1 Addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties.

.2 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.

.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 Conditions, 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. Field test records.

.6 Inspection certificates.

.7 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 black line opaque drawings provided by Contract Administrator.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.6 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 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 AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Contract Administrator approval.

.3 Warranty management plan to include required actions and documents to assure that Contract Administrator receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit, warranty information made available during construction phase, to Contract Administrator for approval prior to each monthly pay estimate.

.6 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 and bonds, executed in duplicate by Subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of Work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.7 Except for items put into use with Contract Administrator's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.8 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, Subcontractors, manufacturers or suppliers involved.

.2 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.
.8 Starting point and duration of warranty period.
.9 Summary of maintenance procedures required to continue warranty in force.
.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
.11 Organization, names and phone numbers of persons to call for warranty service.
.12 Typical response time and repair time expected for various warranted equipment.

.3 Procedure and status of tagging of equipment covered by extended warranties.

.4 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.9 Respond in a timely manner to oral or written notification of required construction warranty repair Work.

.10 Written verification will follow oral instructions. Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.

1.13 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Contract Administrator.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.
.2 Model number.
.3 Serial number.
.4 Contract number.
.5 Warranty period.
.6 Inspector's signature.
.7 Construction Contractor.
.8 Installation Date:

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 SCOPE OF WORK

.1 Provide demonstration and training in accordance with the following:

.1 **Appendix Q - Training Requirements**

.2 In the event of discrepancies between this section and Appendix Q, most stringent requirements shall apply.

1.2 QUALITY CONTROL

.1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Contract Administrator'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.

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 at scheduled times, at the equipment location.

.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.

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 SCOPE

.1 Provide commissioning in accordance with this section.

1.2 ACRONYMS

.1 Cx - Commissioning.

.2 O&M - Operation and Maintenance.

.3 PI - Product Information.

.4 PV - Performance Verification.

.5 TAB - Testing, Adjusting and Balancing.

1.3 GENERAL

.1 CX is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Contract Administrator, to ensure effective performance.

.2 Costs for corrective Work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing to Contract Administrator.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.
.2 Ensure installation of related components, equipment, sub-systems, systems is complete.
.3 Fully understand Cx requirements and procedures.
.4 Have Cx documentation shelf-ready.
.5 Understand completely design criteria and intent and special features.
.6 Submit complete start-up documentation to Contract Administrator.
.7 Have Cx schedules up-to-date.
.8 Ensure systems have been cleaned thoroughly.
.9 Complete TAB procedures on systems, submit TAB reports to Contract Administrator for review and approval.
.10 Ensure "As-Built" system schematics are available.

.4 Inform Contract Administrator in writing of discrepancies and deficiencies on finished Works.

1.6 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

1.7 COMMISSIONING DOCUMENTATION

.1 Contract Administrator to review and approve Cx documentation.

.2 Provide completed and approved Cx documentation to Contract Administrator.

1.8 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.9 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days’ notice prior to commencement.

.2 Contract Administrator representative to witness of start-up and testing.

1.10 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: manufacturer to:
.1 Coordinate time and location of testing.
.2 Provide testing documentation for approval by Contract Administrator.
.3 Obtain written approval of test results and documentation from Contract Administrator before delivery to site.

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Contract Administrator.

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.11 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Contract Administrator after distinct phases have been completed and before commencing next phase.

.4 Document required tests on approved PV forms.

1.12 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Contract Administrator for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Contract Administrator to repeat start-up at any time.

1.13 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Contract Administrator for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.14 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.15 START OF COMMISSIONING

.1 Start Cx after elements of the facility affecting start-up and performance verification of systems have been completed.

1.16 INSTRUMENTS / EQUIPMENT

.1 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Other equipment as required to complete Work.

1.17 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under accepted simulated operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.18 WITNESSING COMMISSIONING

.1 Contract Administrator representative to witness activities and verify results.

1.19 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Contract Administrator within 5 days of test and with Cx report.

1.20 REPEAT VERIFICATIONS

.1 Assume costs incurred by Contract Administrator for third and subsequent verifications where:

.1 Verification of reported results fail to receive Contract Administrator's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Contract Administrator deems Contractor's request for second verification was premature.

1.21 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Contract Administrator.

.2 Report problems, faults or defects affecting Cx to Contract Administrator in writing. Stop Cx until problems are rectified. Proceed with written approval from Contract Administrator.

1.22 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Contract Administrator.

1.23 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.24 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.25 OCCUPANCY

.1 Cooperate fully with Contract Administrator during stages of acceptance and occupancy of facility.

1.26 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with Contract Administrator.

1.27 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10 of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.28 PERFORMANCE TESTING

.1 Performance testing of equipment or system by Contract Administrator will not relieve Contractor from compliance with specified start-up and testing procedures.

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 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings; where required, submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.6 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with Contract Administrator before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .4 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:

.1 Submit 1 copy of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.

.2 Make changes as required and re-submit as directed by Contract Administrator.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Contract Administrator will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of Work. Mark changes as Work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show Work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right-hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Contract Administrator for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

1.3 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One gasket set for each heat exchanger.

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

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

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

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION AND TRAINING

.1 Provide demonstration and training in accordance with the requirements noted in ***Appendix Q -Training Requirements*** and as supplemented herein.

.2 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular Work hours, prior to acceptance.

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

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

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Section includes:

.1 Materials and installation for compressed air system pipe supports.

1.2 RELATED SECTIONS

.1 01 33 00 - Submittal Procedures

.2 01 78 00 - Closeout Submittals.

.3 Mechanical drawings.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.3-22, Process Piping.

.2 ASTM International

.1 ASTM A125-1996(2007), Standard Specification for Steel Springs, Helical, Heat Treated.

.2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.5 Underwriter's Laboratories of Canada (ULC)

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.3 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

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

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Contractor shall engage the services of a qualified and licensed engineer to design supports, hangers, anchors an guides for piping systems.

.2 Design of supports, hangers, anchors and guides shall be based on loading conditions taking into consideration deadweight of filled piping, thermal expansion and seismic zone.

.3 Submit engineer-sealed design drawings of supports for piping systems.

.4 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.5 Base maximum load ratings on allowable stresses prescribed by ASME B31.3 or MSS SP58.

.6 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.7 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.8 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.3 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 13 mm FM approved.

.2 Cold piping NPS 2-1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.

.2 Cold piping NPS 2-1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP69.

.5 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.6 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports to suit O.D. of pipe insulation.

.7 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for riveting to insulation shields.

.8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.9 U-bolts: carbon steel to MSS SP69 with two nuts at each end to ASTM A563.

.1 Finishes for steel pipework: black.

.2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated.

.10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with two springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.9 HOUSE-KEEPING PADS

.1 Where shown on drawings, provide 150 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges, unless otherwise stated.

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 in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: to Canadian Plumbing Code and authority having jurisdiction.

.2 Copper piping: up to NPS 1/2: every 1.5 m.

.3 Steel piping in water service: in accordance with table below. Table listings for straight runs without concentrated loads and where full linear movement is not required. Flexible joint roll grooved pipe shall also have support at joints.

Maximum Pipe Size : NPS	Maximum Spacing Steel
½ to 1	2.4 m
1 ½ to 2	3.0 m
3	3.7 m
4	4.3 m
6	5.2 m
8 to 10	6.0 m
12	7.0 m

.4 Pipework greater than NPS 12: to MSS SP69.

.5 Support piping within 300 mm of concentrated load, such as elbow, tee, valve, flange or other inline component.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.
.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.
.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Section Includes:

.1 Materials and requirements for the identification of new equipment, piping systems, ductwork, valves and controllers, including the installation and location of identification systems.

.2 Comply with the following City of Winnipeg Water and Waste standards:

.1 Identification standard and appendices located in Appendix E and F.

.2 Tag naming standard located in Appendix H.

.3 Paint colour standard located in Appendix J.

1.2 RELATED SECTIONS:

.1 01 33 00 - Submittal Procedures

.2 01 74 11 - Cleaning.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.4 SUBMITTALS

.1 Product Data:

.2 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Product data to include paint colour chips, other products specified in this section.

.4 Samples:

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

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

.2

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.3 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 N/A

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1.
.2 Propane gas: to CSA/CGA B149.1.
.3 Digester gas: to CSA B149.6.
.4 Sprinklers: to NFPA 13.
.5 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

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

.2 Pictograms:

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

.3 Legend:

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

.4 Arrows showing direction of flow:

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

.5 Extent of background colour marking:

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

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

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

.7 Colours and Legends:

.1 Refer to City Standards noted in item 1.1.
.2 Piping to be painted to match colour of existing system.
.3 If discrepancy arises between the colour listed in the City Standards and piping in field, notify Contract Administrator prior to proceeding; the required colour will be selected at this time.

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: black, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

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

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 EQUIPMENT

.1 Identify all equipment with specified tags as indicated on drawings.

2.10 LANGUAGE

.1 Identification in English.

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 Perform Work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Supply, delivery, installation, and commissioning of two hydraulic power units as specified herein.

.2 Include minimum of **three (3)** site visits to North End Sewage Treatment Plant (located at 2230 Main St., Winnipeg, Manitoba, Canada) by the manufacturer as noted in item 3.3 of this specification.

1.2 FINANCIAL ABILITY

.1 The Contractors bidding this job must have financial capacity to purchase the specified equipment per terms and conditions of the equipment vendors. Costs related to financing of equipment/material purchases, if required, shall be included in the tender price.

.2 The City would not approve progress payments for equipment until the equipment has been delivered to site and placed on the final location.

1.3 REFERENCE DOCUMENTS

.1 American Gear Manufacturer's Association (AGMA)
.2 American Institute of Steel Construction (AISC)
.3 American National Standards Institute (ANSI)
.4 American Society of Civil Engineers (ASCE)
.5 American Bearing Manufacturer's Association (ABMA)
.6 American Welding Society (AWS)
.7 American Society of Mechanical Engineers (ASME)

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings shall be furnished and labeled with the equipment name. Manuals shall include the following minimum requirements:

.1 Company names and phone numbers of manufacturers.
.2 2. Name and phone number of vendor for ordering parts.
.3 3. Complete set of mechanical, electrical, and hydraulic drawings for all equipment.
.4 Complete set of catalog cuts, bills of material, and parts lists for all equipment.
.5 Detailed assembly drawings with member sizes and dimensions, hole patterns and material types.
.6 All submittal drawings shall be 17" x 11".
.7 Operating instructions and schedule of routine maintenance.

.3 Submittal manuals shall be submitted to the Contract Administrator for review and approval.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydraulic power unit for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect units from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 HYDRAULIC POWER UNITS (5 AND 6)

.1 The hydraulic power unit for driving each piston pump shall be a completely self contained, factory assembled unit.

.2 The frame shall be made of welded steel construction adequate to support all components and designed to be anchored to a suitable base and include, but not be limited to the following:

.1 Hydraulic oil reservoir mounted above the drive and hydraulic pump. The oil reservoir shall be baffled in two sections, and the minimum reservoir volume shall be 800 litres.

.2 Initial fill of hydraulic oil shall be provided (as per manufacturer's recommendation for duty and service specified herein).

.3 Power unit shall use one electric motor to drive the piston pump circuit. Electric motor shall be 56 kW (75 HP), TEFC, 575VAC, 60 Hz, 3 phase; 40°C ambient rated; 1.15 service factor; Class F insulation; and shall be premium efficiency. Motor shall be rated for operation in Class 1, Zone 2 hazardous environment.

.4 One (1) clean out cover

.5 One (1) sight level indicator

.6 One (1) return line filter (10 micron absolute) with flow bypass and filter contamination switch

.7 One (1) high oil temperature switch

.8 One (1) low oil level switch

.9 One (1) oil pressure switch – oil filter

.10 One (1) oil pressure switch – piston pump

.11 One (1) high motor temperature switch

.12 One (1) ¾-inch reservoir drain with shut off valve

.13 One (1) filter-breather assembly

.14 An axial piston type hydraulic oil pump providing infinitely variable displacement volume, as manufactured by Rexroth shall be provided. This hydraulic oil pump shall control the cake pump operation speed and limit pressure to prevent over pressurization of the cake discharge line. A redundant factory preset pressure relief valve shall limit the peak discharge pressure at slightly higher pressure to avoid excessive heating of oil.

.15 Manual valve shall be provided on suction line to hydraulic pump to isolate pump from reservoir for service.

.16 The power unit shall also incorporate an integral conditioning circuit for cooling and filtering the hydraulic oil.

.1 A constant volume gear pump driven on a common shaft with the main hydraulic pump shall continuously filter hydraulic oil through a 6-micron (absolute) filter and air-cooled heat exchanger on the power unit.

.2 Air cooled heat exchanger shall be fan-coil type with aluminum finned cooling coil and electric fan. Fan motor shall be 575V/3 phase, 1 HP (0.75 kW). Motor shall be suitable for operation in NFPA Class 1, Zone 2 hazardous environment.

.3 Fan operation shall be thermostatically controlled.

.17 Power unit shall be provided with protective panels for sound attenuation and to protect power unit components. Sound panels shall be removeable and fabricated from #14-gauge carbon steel, with 75mm foam insulation, and 1.5 mm thick perforated aluminum retaining baffle.

.18 Dimensions (mm): 2,640 (L) x 914 (W) x 1,680(H)

.19 Weight: 3,300 kg.

2.2 FIELD HYDRAULIC PIPING

.1 Existing rigid hydraulic tubing shall be used to connect the Hydraulic Power Unit to the Sludge Pump. New hydraulic hoses shall be provided with equipment to connect equipment to existing lines. Length and diameter of replacement hoses shall be field verified by installing contractor.

2.3 PAINTING

.1 The following equipment systems shall be protective coated according to the following schedule. Finish colors to be selected by the Owner.

.1 Power units shall be painted as follows:

.1 Surface preparation - Sandblast SSPC-SP6

.2 Two (2) coats of Sherwin Williams Macropoxy 646, 3-5 mils DFT per coat

.3 Color shall be Green, unless specified otherwise.

.2 Total dry film thickness for primer, intermediate and finish coat system shall be a minimum of 6 mils DFT.

.3 Stainless steel surfaces shall remain unpainted.

2.4 PISTON PUMP CONTROLS

.1 Local control enclosure shall be factory wired to the power unit and shall include, but not be limited to:

.1 A LOCAL/REMOTE switch shall be provided for control of the pumping unit.

.1 In the “REMOTE” mode of operation, the pump and screw feeder will be turned on and off from a remote signal generated from the Control Room. In addition, the main hydraulic oil pump speed can be increased or decreased via a 4-20mA signal from the Control Room.

.2 In the “LOCAL” mode, the pump will be started, stopped, and controlled at the local control panel. Speed control will be done through a potentiometer located on the panel.

.2 A BYPASS-LOAD selector switch shall be provided for bypass hydraulic circuit.

.1 This switch controls an electrically operated hydraulic solenoid valve used to direct oil from the hydraulic pump directly back to the reservoir. The purpose of this valve shall be to start the hydraulic system under no load to minimize in-rush current.

.3 Pump speed meter shall be provided on local control enclosure.

.4 Provide an elapsed time meter to indicate the total running time of the power unit in hours.

.5 Local control devices shall be mounted on a hinged sub-panel and connected to a terminal strip in the panel for hardwired plant connections. External panel door shall include no operator devices.

.6 Provide terminal strips to receive wires from external devices with a minimum of 10 percent spare terminals.

.7 Power unit devices shall be wired to terminal strip for hard wire connection to plant interface. Devices include:

.1 High Oil Temperature Switch

.2 Low Oil Level Switch,

.3 Dirty Oil filter switch,

.4 High Oil Pressure switch, and

.5 Motor High Temperature Switch.

.8 Local control enclosure shall be 304 stainless steel, NEMA 4X construction (corrosion resistant) with cUL or CSA approval.

.9 Panel shall be rated for operation in NFPA Class 1, Zone 2 hazardous environment.

.10 Panel shall be provided with a Type Z purging system with instrument air. Purge system shall regulate and monitor enclosure pressure. Purge panel shall include filter-regulator, control valve, pressure gauge, and pressure switch. Separate enclosure protection vent and compressed air solenoid shall be provided. Purge system shall be Pepperl & Fuchs Model 1002 Type Z with EPV-2 enclosure protection vent. Compressed service provided by others; compressed air to be 80 – 120 psi, with 4 scfm maximum flow rate. Provide 120VAC alarm contact for connection to plant for “pressurization failure” alarm.

.11 Control panels shall be in accordance with Section 40 67 00 – Control System Equipment Panels and Racks

.2 All control logic, aside from the valve driver card configuration, shall be accomplished by means of the Plant programmable logic controller (PLC). Owner shall be responsible for any programming changes to integrate new equipment.

.3 Control panel dry contacts to be rated for 120VAC.

2.5 MOTOR STARTER AND DISCONNECTS

.1 Starters for Main Motor and Air Cooler Fan are existing and by others. Supplied motors to be coordinated with existing starters.

.1 Main Motor: Westinghouse A201K4CA NEMA Size 4, Max 100 HP and Westinghouse HMCP Series C Motor Circuit Interrupter, 150A.

.2 Air Cooler Fan Starter: Telemechanique GV1-M06

.2 Provide lockable disconnects for the main motor and air cooler fan motors and locate adjacent to the control panel.

.1 Disconnect to be sized to suit the HP rating of the motor.

.2 Disconnects to be rated for a Class 1, Zone 2 hazardous environment and Nema4X for corrosion resistance.

.3 Refer to 262823 – Disconnect Switches for additional requirements.

2.6 ACCEPTABLE PRODUCT:

.1 Acceptable Product: “Schwing Bioset Inc.” Hydraulic Power Unit Model PP 800/75 HP or approved equal in accordance with B7.

.2 Contact information:

Jeff Joy
Schwing Bioset Inc.
350 SMC Drive
Somerset, WI 54025
Office: (715) 247-3433
Cell: (612) 812-7318
E-mail: jjoy@schwingbioset.com

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydraulic power unit installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Contract Administrator.

.2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.3 INSTALLATION AND TRAINING

.1 The equipment manufacturer shall provide a trained service technician to supervise system installation, assist start-up, and to train owner's personnel in the operation and maintenance of the Biosolids Handling Equipment. The service technician shall be made available for the following number of days:

.1 Installation Assistance 2 days, 1 trip

.2 Start-up and Field Testing, 2 days, 1 trip

.3 Training 2 days, 1 trip (Refer to Section 01 79 00 – Demonstration and Training and Appendix Q – Training Requirements.)

3.4 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements; supplemented as specified herein.

.2 In accordance with manufacturer's recommendations.

3.5 SPARE PARTS

.1 The following spare parts shall be supplied in addition to any mentioned above for the biosolids handling equipment specified herein.

.1 Hydraulic Power Unit

.1 One (1) set of hydraulic oil filters for each Power Unit

.2 Spare parts shall be suitably packaged for long term storage with waterproof labels indicating contents of each package.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections Division 26, Electrical. This Section Supplements the requirements of Division 1.

1.2 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 74 11 – Cleaning

.4 Section 01 91 13 – General Commissioning Requirements

.5 Section 01 91 13.13 – Commissioning Plan

.6 Section 01 91 13.16 – Commissioning Forms

.7 Section 01 91 13.18 – Commissioning Training

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of 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-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

.4 City of Winnipeg, latest adopted revisions of:

.1 Electrical Design Guide (510276-0000-47ER-0001),

.2 Automation Design Guide (612620-0013-40ER-0001)

.3 CAD Drafting Manual

.4 WSTP Identification Standard

.5 WSTP Drawing Content Standard

.6 WWD CAD/GIS Standards

.7 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.4 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.5 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

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

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

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

1.6 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete work, tested, and ready for operation.

.2 These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings, but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.3 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the work.

.4 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B5.

1.7 CARE, OPERATION AND START-UP

.1 Instruct City maintenance and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Where services of a manufacturer’s factory service engineer are required, arrange and pay for services to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

1.8 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.9 SUBMITTALS

.1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division 01 33 00 – Submittal Procedures.

.2 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit copies of 600 x 600 mm minimum size drawings and product data to inspection authorities.

.6 If changes are required, notify Contract Administrator of these changes before they are made.

.3 Quality Control:

.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Permits and fees: in accordance with General Conditions of contract.

.4 Submit, upon completion of Work, load balance report as described in PART 3.9.1 – LOAD BALANCE

.5 Submit certificate of acceptance from inspection authority upon completion of Work to Contract Administrator.

.4 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3.9 – FIELD QUALITY CONTROL.

1.10 AS-BUILT DRAWINGS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, site instructions, clarifications, and revisions for the purpose of As-Built Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. As-Built Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

1.11 QUALITY ASSURANCE

.1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in a provincial apprentice program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

1.12 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Contract Administrator with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

1.13 SYSTEM STARTUP

.1 Instruct Contract Administrator and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance, and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with aspects of its care and operation.

1.14 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with manufacturer’s written instructions.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1.9 - SUBMITTALS

.3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified.

.4 Factory assemble control panels and component assemblies.

.5 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.6 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.7 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

2.2 ELECTRICAL EQUIPMENT MODIFICATION

.1 Where electrical equipment is field modified, arrange for special inspection and pay all associated fees.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of inspection authorities and Contract Administrator.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

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

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical and controls equipment and instrumentation with nameplates and labels as follows:

.1 Lamacoid Requirements as per the City of Winnipeg Electrical Design Guide.

.2 Nameplates: lamacoid 3 mm melamine, white face, black lettering, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.3 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

NAMEPLATE SIZES			
Size 8	50 x 100 mm	2 lines	12 mm high letters

.2 Lamacoid equipment identification structure shall be as per the City of Winnipeg Electrical Design Guide, Lamacoid requirements section.

.3 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.5 Allow for minimum of twenty-five (25) letters per nameplate and label.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.7 Identify equipment with Size 3 labels engraved as directed by Contract Administrator. E.g. “P-L01”

2.7 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.

.5 Identify each wire at termination points with unique wire tag, generally as shown on the drawings. Markers shall consist of machine printed sleeves.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes, and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

.4 Colour coding as per the City of Winnipeg Electrical Design Guide.

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor MCC and distribution enclosures light gray to EEMAC 2Y-1.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

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

3.2 NAMEPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation. Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1200 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

3.6 CUTTING AND PATCHING

.1 Provide all cutting a patching required.

.2 Return exposed surfaces to an as-found condition.

.3 Exercise care where cutting holes existing concrete elements so as not to damage existing reinforcing.

.1 Locate existing reinforcing utilizing a reinforcing bar locator and mark out on the surface of the concrete.

.2 For all holes larger than 50mm passing through reinforced concrete, mark the location of the desired hole and all adjacent rebar. Obtain approval from the Contract Administrator prior to cutting.

.3 Firestop and seal all penetrations, regardless of whether the penetration requires a fire rating.

3.7 ANCHOR INSTALLATION

.1 The Contractor shall exercise care when installing anchors into existing concrete elements so as not to damage existing reinforcing. All anchors shall be installed utilizing carbide tip drill bits. The existing reinforcing shall be located utilizing a reinforcing bar locator and marked out on the surface of the concrete. The drill holes shall be advanced to the required depth for installation of the anchors. Should reinforcement be encountered while drilling, the hole shall be terminated and repositioned to clear the reinforcement. Do not use core bits that can easily intercept and damage/cut the reinforcing during drilling.

3.8 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.9 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1.9 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests:

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system and communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Contract Administrator.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 All test instruments utilized are to have been calibrated within one year of the date utilized.

.6 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1.9 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1.11 - QUALITY ASSURANCE.

3.10 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 RELATED WORK

.1 Division 22 and 23 Mechanical Specifications

.2 Section 26 05 00 Common Work Results for Electrical

.3 Section 26 05 21 Wires and Cables (0-1000 V)

.4 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

.5 Section 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings

1.2 SYSTEM DESCRIPTION

.1 Provide complete electrical power and control connections for mechanical equipment.

Part 2 Products

2.1 MATERIALS

.1 Include motor starters, lockable disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.

.2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices, and fittings required to provide control wiring for mechanical equipment, except for temperature/humidity control systems.

.3 Unless otherwise noted, motors and control devices shall be supplied by Division 23. Motor horsepower ratings shall be as shown in Division 23 specifications. Motor voltage and phase ratings by Division 26.

Part 3 Execution

3.1 POWER WIRING

.1 Install power feeders, starters, lockable disconnects, and associated equipment and make connections to all mechanical equipment.

.2 Install branch circuit wiring for mechanical system control panels, time clocks, and control transformers.

.3 Install main power feeders to starter/control panels furnished by Division 23. Install branch wiring from starter/control panels to controlled equipment such as motors, electric coils, etc.

.4 Conduit, wire, devices and fittings required to wire and connect low voltage temperature control systems, shall be supplied and installed by the trade supplying the temperature control system. Control wiring shall be installed in conduit.

.5 Wire and connect electrical interlocks for starters supplied by Division 23.

3.2 COORDINATION

.1 Refer to mechanical drawings for the exact location of motor control devices, and other mechanical equipment requiring an electrical connection.

.2 Obtain full information from Division 23, regarding wiring controls, overload heaters, equipment ratings and over-current protection. Notify the Contract Administrator at once, if Division 23, contains any provided information is incorrect or unsatisfactory.

.3 Refer to Division 23 specifications for any further electrical requirements.

.4 Review both electrical and mechanical drawings and specifications and coordinate all controls with Mechanical Subcontractors through Electrical Subcontractor. Report all discrepancies to the Contract Administrator before close of Bid. No additional money will be justified for assumptions made on any duplication of information.

.5 Submit to Electrical Subcontractor, as part of the bid submission, a list of controls and wiring to be provided by the Electrical Subcontractor.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Refer to all sections of the specification for related work.

1.2 COORDINATION

.1 Contractor shall allow for off-hours work as required.

.2 Where existing services or systems, such as electrical power, data systems, and equipment alarm systems are required to be disrupted and/or shutdown, coordinate the shutdowns with the Contract Administrator and carry out the work at a time and in a manner acceptable to them. Carefully schedule all disruptions and/or shutdowns and ensure the duration of the same is kept to absolute minimum. Submit for approval, a written concise schedule of each disruption at least 120 hours in advance of performing work and obtain written consent prior to implementing. Allow for after-hours work.

.3 Should any temporary connections be required to maintain services or systems during work in the existing building, supply and install all necessary material and equipment and provide all labour at no extra cost. Should any existing equipment or system be damaged, make full repairs without extra cost, and to the satisfaction of the Contract Administrator.

.4 Refer to General Requirements for phasing and staging of work and adhere to that schedule. Comply with instructions regarding working hours necessary to maintain the building in operation.

.5 Coordinate complete installation of relocated utility services, if required, with utilities to ensure minimum interruption of service. Coordinate the disconnection and re-connection of the existing electrical circuits in order to keep power interruptions to a minimum.

.6 No drilling in concrete floors shall take place unless the floor has been scanned (or x-rayed) to confirm exactly what is in the floor. The Contractor shall notify the Contract Administrator before drilling. The Contractor assumes complete responsibility for any and all damages or work stoppages occurring from unforeseen problems. The Contract Administrator does not want any facility disruptions.

1.3 EXISTING DEVICES IN NEW CONSTRUCTION

.1 Include all costs to x-ray existing floors to be drilled or sleeved to ensure no existing services are severed or damaged. Damages could be very serious. Any damages resulting from failure to x-ray (or scan) is the Contractor's responsibility.

1.4 REMEDIAL WORK

.1 It is the Electrical Contractor's responsibility to ensure that any coring of holes through decks or floor slabs will not penetrate existing conduits, cables or mechanical equipment in walls, ceilings or floor slabs. The Contractor, at his cost, is responsible to take all actions required and as may be deemed necessary by the Contract Administrator to correct any damage. No coring shall be undertaken unless permission is given by the building the Contract Administrator.

Part 2 Products

2.1 MATERIALS

.1 Provide all materials required for the complete interface and reconnection installation.

.2 New wiring required to interconnect new devices to existing systems shall be provided to suit the manufacturer's requirements and instructions.

.3 Add new grounding materials as required to make existing grounding systems good in renovated areas only. Confirm existing on site.

.4 Add modules, switches, etc., in existing control panels, as required, to extend existing systems to the new or renovated areas only. Confirm existing on site.

.5 New system devices, speakers, starters, panelboards, breakers, etc. that are required to be tied into existing systems, quality of new materials to match or exceed existing. Confirm existing on site.

.6 It is the intent of these specifications not to re-use any existing wiring.

Part 3 Execution

3.1 INSTALLATION

.1 Install boxes, conduit and wiring through existing areas as required for the new installation.

.2 Patch and repair walls and ceilings in existing buildings that have been damaged or cut open due to the new electrical installation.

.3 Where new cables or conduits have been installed through existing fire rated walls, seal opening around cables and conduit to maintain fire rating.

.4 Test and confirm all existing grounding systems are effective and in good condition. Include work and materials required to change wiring and make good existing.

.5 Special efforts are required to coordinate conduit routes, etc. with structural, mechanical and other related work.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18.1.13 (R2022), Metallic outlet boxes (Tri-national standard, with UL 514A and ANCE NMX-J-023/1)

.2 CSA C22.2 No.65-18 (R2022), Wire Connectors.

.3 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused wiring materials from landfill to metal recycling facility as approved by Contract Administrator.

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 Clamps or connectors for armoured cable as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

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

.3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No .0.3:09 (R2023), Test Methods for Electrical Wires and Cables.

.3 CAN/CSA-C22.2 No. 131:17 (R2022), Type TECK 90 Cable.

.4 CAN/CSA-C22.2 No. 38-18 (R2022), Thermoset-insulated Wires and Cables

.5 CAN/CSA-C22.2 No. 239:21, Control and Instrumentation Cables

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 Identification Standard

.3 Electrical Design Guide (510276-0000-47ER-0001)

1.3 SHOP DRAWING

.1 Include detail construction, dimension, capacities, weights of equipment or material.

Part 2 Products

2.1 BUILDING WIRES

.1 Wire: to CAN/CSA-C22.2 No. 38, Thermoset-insulated wires and cables.

.2 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.3 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.4 Voltage rating:

.1 Circuits 480 V and less: 600 V

.2 Circuits > 480 V: 1000 V

.3 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90.

.4 Colour coding to Section 26 05 00 – Common Work Results, wires sized #2 AWG and smaller to be factory-coded, taping will not be accepted.

2.2 1 KV TECK90 POWER CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. (12 AWG minimum where not indicated)

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 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 steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels unless indicated otherwise on drawings.

.8 Cable Fittings:

.1 Minimum requirement: Watertight, approved for TECK cable.

.2 Hazardous Locations:

.1 CSA approved.

.2 Watertight type with:

.1 an elastomeric bevelled bushing

.2 a funnel entry, splined gland nut

.3 a non-magnetic, stainless steel grounding device with dual grounding action

.4 a taper threaded hub

.5 a hexagonal body and gland nut

.3 Integral seal type with metal-to-metal contact construction.

.4 Sealing of multi-conductor cable shall be accomplished with a liquid type polyurethane compound.

.5 The fitting must:

.1 Provide an environmental seal around the outer jacket of the cable and electrically bond the fitting to the cable armour prior to potting the explosion-proof seal.

.2 Allow the possibility of disconnection without disturbing the environmental seal, the electrical bonding or the explosionproof seal.

.6 All metal-clad cable fittings, for jacketed and non-jacketed interlocked armour cable, shall incorporate an easily removable armour stop (not requiring fitting disassembly) ensuring proper positioning of the cable armour during cable termination.

.7 Approved products:

.1 T&B Star Teck XP series or approved equal in accordance with B8.

2.3 600 V TECK90 CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. (14 AWG minimum where not indicated)

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.4 VARIABLE FREQUENCY CONTROL CABLE

.1 Cable: Variable frequency drive cable to CAN/CSA C22.2 No. 131.

.2 Conductors:

.1 Copper power and ground.

.3 Ground Conductors:

.1 Three bare ground conductors spaced evenly around circumference of cable (sectored ground).

.4 Insulation:

.1 Cross linked polyethylene, 2000V.

.5 Armour:

.1 Continuous aluminum sheath formed into corrugates seamless heath.

.6 Outer Jacket:

.1 PVC, UV resistant.

.7 Fire rating: FT4, HL and AG14.

.8 Connectors:

.1 Same as for TECK90 cables.

.9 Standard of Acceptance: Nexans DriveRX cable or approved equal.

2.5 300 V INSTRUMENT ACIC/CIC CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

.2 Conductors: 16 AWG where not indicated on drawings, 7 strand concentric lay, Class B tinned copper, twisted pairs/triads.

.3 Insulation: PVC TW75, 75 °C Wet, 105 °C Dry (-40 °C), 300 Volt.

.1 Cables shall have 600V rating when entering 600V equipment such as MCCs and VFDs.

.4 Twisted pairs/triads cabled with staggered lays.

.5 Shielding: Individual twisted pair(s)/triads Aluminum/mylar shield with ST drain wire, 100 % shield. Overall aluminum/mylar shield with ST drain wire. Individual drain wires one size smaller than conductor AWG. Overall drain wire the same AWG as conductors.

.6 Armour: interlocking aluminum.

.7 Overall covering: thermoplastic polyvinyl chloride material (90 °C, -40 °C).

.8 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.9 Connectors:

.1 Watertight, explosion proof approved for armoured cable.

2.6 TYPE RW90 CONDCUTOR

.1 In accordance with CSA C22.2 No.38.

.2 Circuit conductors shall be concentric stranded soft copper, size as indicated (12 AWG minimum where not indicated).

.3 Insulation to be chemically cross-linked thermosetting polyethylene rated type RW90 XLPE, 600V.

.4 Suitable for installation in temperatures down to -40 °C.

.5 90 °C conductor operating temperature.

2.7 WIRING IDENTIFICATION

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

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.2 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit and Conduit Fittings.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0 -1000 V.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0 -1000 V.

3.4 INSTALLATION OF CONTROL CABLES

.1 Ground shields at one end only. Where possible, ground shields at the end where power is supplied to the cable. Utilize shield grounding bar in panels, where present, to ground overall shields. Individual pair shields to be grounded on appropriate terminals.

.2 Shield drain wires, at the ungrounded end, are to be taped back to the cable. Fully insulate the shield. Do not cut the shield drain wire off.

.3 ACIC cable may be installed in cable tray, provided that:

.1 The cable tray does not contain power cables, unless specifically authorized by the Contract Administrator in writing.

.2 The ACIC cable voltage rating is equal or greater than the highest voltage contained in the cable tray.

3.5 TERMINATIONS AND SPLICES

.1 Wire nuts are permitted only in the following circuits:

.1 Lighting circuits.

.2 Receptacle circuits.

.2 Exercise care in stripping insulation from wire. Do not nick conductors.

.3 Strictly follow manufacturer's instructions with regards to tool size and application methods of terminations and compounds.

.4 Where screw-type terminals are provided on equipment and instrumentation, terminate field wiring with insulated fork tongue terminals.

.1 Manufacturer: Thomas and Betts, Sta-Kon, or approved equal in accordance with B8.

3.6 INSTALLATION IN CONDUIT

.1 Utilize cable grips, appropriately selected to accommodate the type and geometry of the cable.

.2 Utilize cable pulling lubricant, compatible with the cable and conduit.

3.7 CABLE INDENTIFICATION

.1 Install cable tags on all cables.

3.8 TESTING

.1 Test all power conductors #10 AWG and larger in accordance with 26 05 00 – Common Work Results.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-2014, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.3 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Contract Administrator.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required.

.2 Grounding conductors: stranded copper, tinned, soft annealed, size as indicated.

.3 Insulated grounding conductors: green, type RW90.

.4 Ground bus: copper, size #2/0 AWG, complete with insulated supports, fastenings, connectors.

.5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

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.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.8 Connect building structural steel and metal siding to ground by welding copper to steel.

.9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.10 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.

.11 Ground secondary service pedestals.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of 600 V system

.2 Install system and circuit ground connections at secondary of 600V:120/208V transformers.

3.3 EQUIPMENT GROUNDING

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

3.4 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room.

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.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0 AWG.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections for telecommunication, sound, fire alarm, intercommunication systems as follows:

.1 Telecommunication systems: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, intercommunication systems as indicated.

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 and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Contract Administrator.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 FRAMING AND SUPPORT SYSTEM

.1 Materials:

.1 Conduit support structures shall employ an aluminum strut framing system together with the manufacturer's connecting components and fasteners for a complete system.

.2 Finishes:

.1 Wet locations: Aluminum.

.2 Indoors, dry locations: Aluminum.

.3 Nuts, bolts, machine screws: Stainless steel.

2.2 CONCRETE AND MASONRY ANCHORS

.1 Materials: hardened steel inserts, zinc plated for corrosion resistance.

.2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four.

.3 Manufacturer: Hilti (Canada) Limited or approved equal in accordance with B8.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 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 steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures as 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.

.13 Touch up abraded surfaces and cut ends of galvanized members with an approved galvanizing repair compound.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Include detail construction, dimension, capacities, weights of equipment or material.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 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.

.3 Type and size as indicated on the drawings, or sized as per code requirements

.4 Utilize stainless steel or PVC construction for NEMA 4X junction and pull boxes.

2.2 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing sheet steel backboard for surface mounting.

Part 3 Execution

3.1 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 blocks 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.

3.2 IDENTIFICATION

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

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 NO. 18.1:13 (R2022), Metallic Outlet Boxes

.2 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

.6 Material Requirements:

.1 Main Floor & Drywell: PVC

.2 Wet well: Aluminium

.3 Valve Chamber: Aluminium

2.2 SURFACE MOUNTED OUTLET BOXES, METAL

.1 General Requirements:

.1 Acceptable materials:

.1 Cast Aluminum

.2 Cast ferrous alloy with corrosion resistant epoxy coating.

.2 Finish

.1 Epoxy Enamel

.3 Mounting lugs as required.

.4 Wet location covers for all locations unless otherwise approved by the Contract Administrator.

.5 To CSA C22.2 NO. 18.1:13 (R2022)

.2 Round Boxes:

.1 100 mm (4") round.

.2 Tapped conduit openings and plugs.

.3 Manufacturer / Model:

.1 Crouse Hinds VXF series

.2 Or approved equal in accordance with B8.

.3 Device Boxes

.1 FS or FD cast aluminum boxes with factory threaded hubs and mounting feet for surface wiring of receptacles.

.2 Single gang unless specified otherwise.

.3 Manufacturer / Model:

.1 Crouse Hinds FS/FD series

.2 Or approved equal in accordance with B8.

2.3 SURFACE MOUNTED OUTLET BOXES, PVC

.1 General Requirements:

.1 To CSA C22.2 No. 18.

.2 Acceptable materials: PVC

.3 Grounding stud.

.4 Mounting lugs as required.

.5 NEMA 4X, unless otherwise indicated.

.2 Specific Requirements:

.1 Ceiling Outlets: IPEX OB series or approved equal in accordance with B8.

.2 Device Boxes: IPEX FS/FD series or approved equal in accordance with B8.

2.4 CONDUIT BOXES FOR PVC CONDUIT

.1 Non-metallic PVC boxes with mounting feet for surface wiring of devices.

.2 Acceptable products: Ipex or approved equal in accordance with B8.

2.5 MASONRY BOXES

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

2.6 CONCRETE BOXES

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

2.7 CONDUIT BOXES

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

2.8 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.9 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2-piece die-cast aluminum with brushed aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18.1:13 (R2022), Metallic outlet boxes (Tri-national standard, with UL 514A and ANCE NMX-J-023/1).

.2 CSA C22.2 No. 45-M1981(R2008), Rigid Metal Conduit.

.3 CSA C22.2 No. 56 (R2022), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 211.2:06 (R2021), Rigid PVC (Un-plasticized) Conduit.

.5 CAN/CSA C22.2 No. 227.1:19 (R20223, Electrical Non-metallic Tubing.

.6 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

.2 Winnipeg Water and Waste Department Electrical Design Guide

.3 Submittals

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures for the following:

.1 Conduit fittings

.2 Fittings for hazardous locations.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

Part 2 Products

2.1 GENERAL

.1 Material Requirements:

.1 Non-hazardous circuits: PVC

.2 Hazardous circuits: Rigid Aluminum (threaded)

□

2.2 RIGID PVC CONDUIT

.1 Meets CSA C22.2 No. 211.2.

.2 Minimum conduit size: 19 mm, unless specifically indicated on the drawings or approved by the Contract Administrator.

2.3 FLEXIBLE METAL CONDUIT

.1 To CSA C22.2 No. 56, liquid-tight flexible metal.

.2 Minimum conduit size: 19 mm, unless specifically indicated on the drawings or approved by the contract administrator.

2.4 RIGID METAL CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, aluminum, threaded.

2.5 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

.2 Two-hole steel straps for conduits larger than 50 mm.

.3 Beam clamps to secure conduits to exposed steel work.

.4 Channel type supports for two or more conduits at 1.5 m oc.

.5 Threaded rods, 6 mm dia., to support suspended channels.

2.6 CONDUIT SPACERS

.1 PVC coated malleable iron spacers, CSA approved for the purpose.

.2 Aluminum channel may be utilized where conduits are grouped, however a non-metallic spacer must be provided between the aluminum channel and concrete.

2.7 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified.

.2 Coating: same as conduit.

.3 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.4 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.8 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.

□

2.9 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 ROUTING

.1 Locate conduits containing communication and low voltage conductors away from conduits containing power wiring.

.2 Route conduits on existing or new pipe rack or suspended channels where possible.

.3 Avoid routes that would interfere with any potential maintenance activities such as but not limited to:

.1 Roof hatches.

.2 Mechanical Dampers.

.3 Building/Equipment door openings and hoists.

.4 Where not specifically shown in detail on the drawings, review proposed conduit routing with contract administrator prior to installation. Comply with all routing changes requested by the Contract Administrator.

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits in finished areas.

.3 Surface mount conduits except in mechanical and electrical service rooms and in unfinished areas.

.4 Use rigid aluminum threaded conduit except where specified otherwise.

.5 Use explosion proof flexible connection for connection to explosion proof motors.

.6 Install conduit sealing fittings in hazardous areas. Fill with compound. Refer to hazardous are location plan drawings.

.7 Minimum conduit size for lighting and power circuits: 19 mm.

.8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.9 Mechanically bend steel conduit over 19 mm dia.

.10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.11 Install fish cord in empty conduits.

.12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.13 Dry conduits out before installing wire.

□

.14 Install ground bonding wire in all conduits. Size bonding wire as per CEC Table 16.

.15 Underground Conduits

.1 Slope conduits to provide drainage.

.16 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on suspended or surface channels.

.3 Provide a minimum space of 12 mm between conduits.

.4 Do not pass conduits through structural members except as indicated.

.5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

.6 Install spacers as required to provide a space between the conduits and the supporting surface, with a minimum space as follows:

.1 Above grade spaces not classified as CEC Category 1 or 2:

.1 Drywall / Wood surfaces: no space required

.2 Masonry / concrete surfaces: 6 mm

.2 Below grade spaces: 12 mm

.17 Colour Coding

.1 As per the City of Winnipeg Electrical Design Guide

3.3 PVC CONDUIT

.1 Concrete Penetrations:

.1 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.

.2 Maximum spacing between supports for rigid PVC conduit:

.1	27 mm conduit	0.75 m
.2	35 mm conduit	0.75 m
.3	41 mm conduit	1.2 m
.4	53 mm conduit	1.5 m
.5	63 mm conduit	1.5 m
.6	78 mm conduit	1.5 m
.7	91 mm conduit and larger	2.0 m

□

3.4 METAL CONDUIT

.1 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.2 Mechanically bend conduits over 19 mm in diameter.

.3 Concrete Penetrations:

.1 Sleeves for Aluminum Conduit

.1 Install schedule 40 galvanized steel pipe, sized for free passage of conduit.

.2 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.

.2 Maximum spacing between supports for rigid metallic conduit:

.1	16 mm conduit:	1.0 m
.2	21 mm conduit:	1.5 m
.3	27 mm conduit	1.5 m
.4	35 mm conduit	2.0 m
.5	41 mm conduit and larger	2.5 m

3.5 LIQUID-TIGHT FLEXIBLE CONDUIT

.1 Use as raceways at all motors, pipe-mounted control devices, and other devices subject to movement or water.

.2 At all motors provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus four times the conduit diameter.

.3 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

3.6 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

.7 Provide stand-of conduit clamp / clip.

3.7 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

□

.3 Do not install conduits in terrazzo or concrete toppings.

3.8 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 is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.9 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.10 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.11 INSTALLATIONS IN CATEGORY 1 LOCATIONS

.1 Arrange to provide drainage at frequent intervals to suitable locations.

.2 Equip with approved fittings to permit the moisture to drain out of the system.

.3 Install the conduit with a minimum of 12 mm space from the supporting surface.

.4 Install every joint to be watertight.

.5 Where conduit leaves a warm room and enters a cooler atmosphere, seal the conduit and arrange the conduit in a manner to avoid condensation accumulation at the seal.

3.12 INSTALLATIONS IN CATEGORY 2 LOCATIONS

.1 Comply with all requirements of Category 1 locations.

3.13 INSTALLATIONS IN HAZARDOUS ZONE 1 LOCATIONS

.1 Explosion proof conduit sealing fittings:

.1 Install sealing fittings as indicated and on all new conduit installations to meet CEC requirements.

.2 Add sealing compound following manufacturer’s instructions.

□

3.14 INSTALLATIONS IN HAZARDOUS ZONE 2 LOCATIONS

.1 Explosion proof conduit sealing fittings:

.1 Install sealing fittings as indicated and on all new conduit installations to meet CEC requirements.

.2 Add sealing compound following manufacturer's instructions.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

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

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42:10 (R2022), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1:13 (R2022), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55:15 (R2020), Special Use Switches.

.4 CSA-C22.2 No.111-18 (R2023), General-Use Snap Switches (Trinational standard with UL 20 and NMX-J-005-ANCE)

.5 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, double pole, three-way, four-way industrial grade switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111 as required.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver cadmium oxide contacts.

.3 Fully enclosed with urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Brown toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 1200 Series or equivalent.

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 or Brown 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 back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Brown urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Four 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: Hubbell 5252 or equivalent.

.6 Receptacles located in hazardous areas shall be rated for the area and suitable for connected/disconnecting of equipment while circuit is live.

2.3 COVER PLATES

.1 Stainless steel or PVC cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Weatherproof double lift spring-loaded stainless steel or PVC cover plates, complete with gaskets for duplex receptacles as indicated on the drawings.

.6 Weatherproof spring-loaded stainless steel or PVC cover plates complete with gaskets for single receptacles or switches as indicated on the drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mount lighting fixture receptacles local to fixtures.

.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.

.4 Install a permanent label or lamacoid for all wiring devices indicating the circuit(s) contained within.

.1 Example: L75-2 (Panel L75, circuit 2)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4:16 (R2020), Enclosed and Dead-front Switches.

.2 CSA C22.2 No.39:13 (R2022), Fuse holder Assemblies.

.3 Latest adopted version of CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 City of Winnipeg

.1 Winnipeg Electrical By-law including Technical Interpretations, latest edition

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Indicate:

.1 Mounting method and dimensions.

.2 Enclosure types.

.3 Current rating.

.4 For fused disconnects, indicate fuse type.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 sized as per drawings.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

.6 Fuses: size as indicated on drawings; Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification. Fuses to be product of one manufacturer:

.1 Class L fuses.

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

.2 Class J fuses.

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

.3 Class R -R fuses.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits

.4 Class C fuses.

.7 Fuse holders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.

.8 Install fuses in mounting devices immediately before energizing circuit

.9 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install rejection clips for Class R fuses.

.10 Ensure correct fuses fitted to assigned electrical circuit

.11 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment

.12 Label fused disconnects with maximum fuse size. Ex. “MAX. 30A FUSE”

2.2 EQUIPMENT IDENTIFICATION

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

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches as indicated and in accordance with the manufacturer’s recommendations.

.2 Mount securely such that top of switch is a maximum of 1600 mm (63”) above finished floor. Provide a minimum of 1000 mm (39”) clear floor space in front of the switch.

3.2 EQUIPMENT IDENTIFICATION

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

.2 Nameplate for each disconnect switch Size 8 engraved in accordance with Section 26 05 00, Common Work Results – Electrical. Indicate disconnect equipment number, voltage, phase and MCC source feed.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Provide all testing and commissioning for all Process Control System (PCS) and automation components necessary to confirm the functional performance for the equipment and systems, including complete commissioning and demonstration of the new work integrated and working on the existing PCS.

.2 Testing is performed to:

.1 Demonstrate and document that the entire PCS is operating in accordance with the design requirements;

.2 Contribute to the safe and reliable operation of the plant; and

.3 Provide a baseline result for routine maintenance of system and related components.

1.2 REFERENCES

.1 Comply with latest adopted edition of the codes and standards applicable and/or referenced in Related Sections:

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

.2 City of Winnipeg Automation Design Guide

.3 City of Winnipeg Electrical Design Guide

1.3 SUBMITTALS

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

.2 SIT Plan:

.1 Contractor shall submit the SIT plan for Contract Administrator approval.

.2 The SIT plan provided by Contractor shall include:

.1 Scope of the test, including hardware, software, programming, configuration, documentation etc.

.2 Tests to confirm interoperability of systems involved.

.3 Any functional test to be re-performed after interface to package control system.

.3 Supplement submittal documentation as needed to provide adequate records of testing and commissioning activities in accordance with accepted industry practice.

.4 The site testing must demonstrate that the new vendor skids are providing/receiving signals from the City PCS as expected and within industry standard bounds.

.5 Issue submittals for Contract Administrator review and acceptance in accordance with the project schedule as defined herein and in a timely manner to ensure that all required documentation is in place prior to the commencement of any testing or commissioning activities.

.6 Coordinate the submittals detailed in other sections of the specifications with the requirements defined in this section to achieve a complete set of documentation without overlap or gaps.

Part 2 Products

2.1 TESTING EQUIPMENT

.1 Typical test equipment to perform test, configuration, calibration and loop checks include but are not limited to:

- .1 Digital multimeter.
- .2 Portable pressure calibrator.
- .3 Dead weight tester.
- .4 Precision pressure gauge.
- .5 Temperature calibrator.
- .6 Temperature calibration bath.
- .7 Standard temperature sensor and meter.
- .8 Loop calibrator.
- .9 Hand-held oscilloscope.
- .10 Ethernet fiber and copper network tester.
- .11 Profibus PA and DP segment tester if applicable.
- .12 Profibus PA hand-held field communicator if applicable.
- .13 HART hand-held field communicator if applicable.
- .14 Two way radio.

2.2 TESTING EQUIPMENT CALIBRATION

.1 Contractor shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

.2 The firm providing calibration services shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.

.3 Instruments shall be calibrated in accordance with the following frequency schedule:

- .1 Field instruments analog and digital: twelve (12) months maximum;
- .2 Laboratory instruments: twelve (12) months maximum;
- .3 Leased specialty instruments: twelve (12) month maximum.

.4 Dated calibration labels shall be visible on all test equipment.

.5 Calibrating standard shall be of better accuracy than that of the instrument tested.

Part 3 Execution

3.1 GENERAL

.1 The testing activities described herein applies to all components and systems that make up the entire Process Control System for the work provided under this project.

.2 All test reports shall include:

- .1 The date.
- .2 The name, title, and company of the personnel performing the test. Document any required qualifications held.
- .3 The conditions during the test as applicable (weather, process conditions, etc.)

.4 The name, title, and company of the representative observing the test.

3.2 QUALIFICATION OF PERSONNEL

.1 The personnel performing the field tests and commissioning shall be experienced and thoroughly familiar with the apparatus and systems being tested and commissioned. They shall be capable of conducting the tests and commissioning activities in a safe manner, analyze the test data and make a decision on operability of specific equipment and system.

.2 The Contract Administrator shall witness the testing and commissioning.

.3 Contract Administrator's representatives shall observe the testing and commissioning.

3.3 PREPARATION

.1 Carry out all testing and pre-commissioning activities as required herein.

.2 Coordinate all pre-commissioning schedules with the Contract Administrator.

.3 Keep accurate records of all works completed and submit final documentation for each pre-commissioning activity as it's completed for each portion of the project. Certify all final submissions as accurate and true.

.4 Prepare Commissioning Plan.

.5 Submit Commissioning Plan for review and approval by Contract Administrator.

.6 Coordination and schedule and manufacturer's assistance as required.

.7 Provide any manufacturer's instructions in the commissioning plans.

.8 Loop Checks:

.1 Perform loop checks to verify proper operation of all loops prior to commissioning.

.2 Check Documentation.

.3 Visually inspect the installation.

.4 Verify the loop functionality.

.9 Instrument system tests:

.1 Demonstration of operation of all equipment in all control modes as documented in the Process Control Narratives.

.10 Produce test reports for all performed tests and results and provide in the O&M Manuals.

3.4 CONTRACTOR REPRESENTATIVE

.1 Designate and furnish one or more Contactor personnel to coordinate and expedite all testing activities and documentation functions.

.2 Contractor representative(s) to coordinate all testing works carried out by specific equipment Vendors in accordance with the planning and schedules submitted by the Contractor.

.3 Representative(s) to attend all meetings concerning the commissioning function as may be requested by the Contract Administrator. Representative(s) to be available at all times during the testing, pre-commissioning, commissioning and performance evaluation phases of the project.

3.5 CONTRACT CLOSEOUT

.1 Provide testing reports in accordance with Section 01 78 00 – Closeout Submittals.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Electrical Division 26

.2 1-0101-EGAD-W001

.3 1-0101-AGAD-W001

.4 1-0101-AILD-W150-001 and -002

.5 1-0101-AILD-W160-001 and -002

.6 City of Winnipeg Section W600 Control Narrative and associated documents.

1.2 INTRODUCTION

.1 This control narrative is to act as a supportive document to the existing W600 and this document contains the control system changes related to the replacement of sludge cake pumps 5 and 6. Refer to W600 for further information regarding the dewatering operation such as start-up, shutdown, and maintenance, as well as control behaviour of the remaining sludge cake pumps skids (1 through 4).

.2 This document records the changes to the existing sludge cake pump control system resulting from the replacement of sludge cake pumps 5 and 6 and should be read in conjunction with the existing W600 document.

.3 Refer to W600 for further information regarding the dewatering operation such as start-up, shutdown, and maintenance.

1.3 PURPOSE

.1 The purpose of the Sludge Cake Pumping System is to transfer Sludge Cake (dewatered sludge) from each centrifuge to storage bins in the truck loading bay of the Dewatering Building.

1.4 SLUDGE CAKE HYDRAULIC PUMP SKID SYSTEM DESCRIPTION

.1 Sludge cake from each centrifuge falls into a dedicated sludge cake hopper below the centrifuge.

.2 Refer to W600 for further information on overall dewatering system operation.

1.5 PROCESS COMPONENTS

.1 The new 5 and 6 sludge cake pump skids consist of the following components. The new units were retagged to suit the current City of Winnipeg naming convention. Tags of the previous units are in brackets.

- .1 Positive displacement axial piston hydraulic pump complete with 75 hp motor:
  - .1 HPP-1550.MTR (W155-CAP)
  - .2 HPP-1560.MTR (W165-CAP)
- .2 Water reservoir
- .3 Oil circulating static pump with shaft driven by the main drive:
  - .1 HPP-W1550.P (W158-OCM)
  - .2 HPP-W1560.P (W168-OCM)

.4 Air/Oil Cooler (radiator) complete with 1 hp motor:

.1 HPP-W1550.HE (W157-AOC)

.2 HPP-W1560.HE (W167-AOC)

.5 Swash Plate Control Motors W156-SWP and W166-SWP have been decommissioned. Unlike the original sludge pump skids, the new skids 5 and 6 do not utilize dedicated motors for the swash plates.

.2 Refer to the electrical layout, automation layout, and loop drawings for details and locations of all equipment listed above.

Part 2 Control

2.1 PANEL CONTROL

.1 The main drives are controlled from the operations workstations. The Schwing powerpack can be placed in “AUTO” or “MANUAL” mode and started or stopped while in “MANUAL” mode. From the workstations, operators can monitor “On/Off” and “Load/Bypass” statuses of the drive in addition to the following alarms:

.1 “MAJOR ALARM”

.2 “HI OIL PRESSURE”

.3 “HI OIL TEMPERATURE”

.4 “LO OIL LEVEL”

.5 “HI MOTOR TEMP”

.6 “HI DISCHARGE PRESSURE”

.7 “DIRTY OIL FILTER”

.8 “PANEL PRESSURE FAIL” (additional alarm for sludge cake pumps 5 and 6)

.2 The new “PANEL PRESSURE FAIL” alarms for both sludge cake pump 5 and 6 indicates that the pressurized local control panels (LCP-1550 and LCP-1560) have not been able to maintain enough pressure to keep potentially explosive gases from entering the panels.

.3 All alarm conditions activate a latched alarm, which may be cancelled by pushing the “ALARM REST” button on the workstation display for the associated cake pump.

.4 The cooling fans are controlled by local on/off switches on the hydraulic units beside the local control panel. If switched on, they run when the unit is running. Previously the skids did not typically generate enough heat to require the fans. It is recommended that the new skids leave the fans on until operations have determined whether the newer units require more cooling than the previous equipment.

.5 The new oil circulating pumps are dependent on the main drive and cannot be independently controlled.

.6 As mentioned previously, unlike the existing and remaining sludge cake pumps, skids 5 and 6 do not have an independent motor for their swash plates. However, operator control of the new units is the same.

.1 At the operator workstation, an “AUTO/MAN” selector allows an operator to manually control the motor speed by selecting a speed setpoint between 0 and 12 strokes per minute. The “LOAD/BYPASS” selector allows an operator to bypass the hydraulic pump unit (the load) and let the motor circulate the oil freely with no pumping being done.

.2 Additionally, the swash plate motors can each be controlled from local control panels. The locations of the panels are shown on 1-0101-EGAD-W001 and 1-0101-AGAD-W001. From here an operator can select “REMOTE/LOCAL” control, “START” or “STOP” the motor, select “LOAD/BYPASS” mode, “INCREASE” or “DECREASE” variable motor speed, and view monitor pump speed and elapsed running time. Local control from this panel is primarily used by maintenance staff while servicing the sludge cake pump.

2.2 AUTOMATIC CONTROL

.1 Automatic control of the sludge cake pumping is provided by the DCS and the Programmable Logic Controller (PLC) in FDP-W2. FDP-W2 contains three PLCs, which each control a pair of sludge cake pumps, one for 1 & 2, another for 3 & 4, and the last one for 5 & 6.

.2 Previously, the 5/6 PLC adjusted the speed of the pumps through “speed increase” or “speed decrease” pulses. The new skids for sludge cake pumps 5 and 6 now adjust their speed based on a continuous analog signal from the PLC.

.3 In automatic mode:

.1 Conditions for the DCS to issue a permissive start remain unchanged and are as documented in W600 Part C.2 “Automatic Control”.

.2 Conditions for the DCS to issue a stop remain unchanged and are as documented in W600 Part C.2 “Automatic Control”.

.3 After permissive from the DCS has been given to the PLC, the PLC will operate the pumps as described in W600. The oil circulation pump not longer requires a dedicated call to start, otherwise all other functions remain unchanged.

2.3 MANUAL CONTROL FROM MAINTENANCE LOCAL CONTROL PANELS

.1 The local control function of the new sludge cake pump skids 5 and 6 is unchanged from that described in W600, Part C.3.

2.4 INDIVIDUAL UNITS

.1 The new skid 5 and 6 sludge cake pumps consist of the following components:

.1 Sludge Cake Pump Main Drives:

.1 HPP-1550.MTR (W155-CAP)

.2 HPP-1560.MTR (W165-CAP)

.3 Pump: Schwing, Model: TBD

.4 Motor: Make TBD, 75 hp, 575 V, 3Ø, 60Hz, RPM TBD, FLA TBD

.2 Swash Plate Motors W156-SWP and W166-SWP have been decommissioned. The new skids 5 and 6 no longer utilize motors to adjust the swash plates.

.3 Air/Oil Cooler Fan Motor (radiator):

.1 HPP-W1550.HE (W157-AOC)

.2 HPP-W1560.HE (W167-AOC)

.3 Radiator: Make and Model TBD

.4 Motor: Make TBD, 1 hp. 575 V, 3Ø, 60 Hz, RPM TBD, FLA TBD

.4 Oil circulating static pump:

.1 HPP-W1550.P (W158-OCM)

.2 HPP-W1560.P (W168-OCM)

.3 Pump: Make and Model TBD

.4 Motor: pump is driven by main motor

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Comply with latest edition of the codes and standards applicable and/or referenced in Related Sections:

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

.2 Section 40 05 01 – Common Work Results for Automation

.2 Canadian Standards Association (CSA International),

.1 C22.2 No.205-M1983(R2004), Signal Equipment.

.3 International Electrotechnical Commission (IEC)

.1 IEC 61131, Programmable Controllers.

.4 City of Winnipeg Design Standards,

.1 Tag Naming Standard, 612620-0014-40ER-0001 Rev. 00.

1.2 DEFINITIONS

.1 “PLC” means Programmable Logic Controller

.2 “FAT” means Factory Acceptance Testing. All FAT type testing to be performed at the equipment vendor facilities, utilizing the equipment vendor’s labor, materials and test equipment

.3 “I/O” means Input/Output

1.3 SOFTWARE OWNERSHIP

.1 The City will fully own all PLC programming logic supplied and may utilize the software provided for any purpose including:

.1 Modification and revision.

.2 Use at other City facilities.

.2 The City may turn the software over to a 3rd party, for use at any City owned facility.

.3 Provide source code for all custom software and function blocks or any other software logic utilized in the application.

.1 Source code for base function blocks provided by the PLC manufacturer are not required.

1.4 DESIGN REQUIREMENTS

.1 Design, supply, and installation programmable logic controller (PLC) and Remote IO (RIO) based control panels for each process area in accordance with the requirements of these Specifications and associated drawings.

.2 Terminal blocks and associated components shall be housed in the same control panel as the associated IO Card.

.3 Development of the PLC programs and integration of the new equipment into the main Process Control System (PCS) are to be provided by the City.

.4 Input conditioning to map inputs from physical inputs and networked devices to internal PLC tags.

.5 Output conditioning to map internal PLC tags to physical outputs and networked devices.

.6 Do not assume that the Contractor's internal standards or standard installation methodology will be acceptable for this project. No additional payment will be made for assumptions made regarding standard methods utilized by the Contractor.

.7 The Contract Administrator will review the overall design. Make changes as requested by the Contract Administrator.

1.5 SUBMITTALS

.1 Submit the following in accordance with Section 01 33 00, and Section 40 95 13 - Control Panels

.1 For each component and material submit Shop Drawing which shall include:

.1 Manufacturer.

.2 Model number.

.3 General data and description.

.4 Engineering specifications and data sheets.

.5 Catalog cuts.

.6 For information purposes only, submit manufacturer's printed installation instructions.

.2 For each process area submit a detailed PLC network diagram that show the PLC rack configuration and connections including redundant connections to the PCS.

.2 All submittals to be in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit product datasheets and PLC panel hardware shop drawings.

.2 Submit operation and maintenance manuals as described in Part 1.6 of this Specification.

1.6 OPERATION AND MAINTENANCE MANUALS

.1 Operation and maintenance manuals to be submitted in accordance with Section 01 78 00 – Closeout Submittals.

.2 Include the following in the operation and maintenance manuals:

.1 Product datasheets.

.2 Hardware and software user manuals.

1.7 QUALITY ASSURANCE

.1 Provide in accordance with Section 01 45 00 and as specified.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Provide in accordance with Section 01 61 00 and as specified.

1.9 WARRANTY

.1 The Contractor shall warrant that all materials and equipment furnished under the Contract are in good working order, free from defects, and in conformance with system specifications. All installed equipment shall conform to the manufacturer's official published specifications. The warranty shall begin at the system acceptance date and remain in effect for a period of one (1) year from that date. The Contractor shall agree to repair, adjust, and/or replace (as determined by the Contract Administrator to be in its best interest) any defective equipment, materials, or other parts of the system at the Contractor's sole cost. The City will incur no costs for service or replacement of parts during the warranty period of one (1) year. All third party warranties shall be passed through from the Contractor to the City.

.1 The system acceptance date shall be unique for each area based upon the successful completion of the switchover, commissioning, training, demonstration period, and O&M and as-built submittals for that work.

.2 The Contractor shall warrant that all programmable logic developed for the project shall be free from defects leading to unintended operation of the plant equipment. The programmable logic will be based on the Process Control Narrative. warranty shall begin at the system acceptance date and remain in effect for a period of one years from that date. The Contractor shall agree to repair or adjust the programmable logic card if defects are found. The Contractor shall expedite the repair or adjustments to the level of severity to ensure no additional damages occur to the plant, personnel, or treatment capacity occur.

.1 The City shall be allowed to make urgent or required corrections to the programmable logic to benefit the plant at their discretion. Adjustment to portions of the programmable logic does not remove the warranty coverage for any of the existing programming and calibration produced by the Contractor.

.3 The Contractor shall warrant and supply evidence that the installation of materials and hardware will be made in strict compliance with all applicable provisions of the Canadian Electrical Code.

.4 The Contractor shall warrant that the system will function in accordance with the manufacturer's published technical description guide.

Part 2 Products

2.1 PROGRAMMABLE LOGIC CONTROLLER

.1 Provide all required hardware for a complete installation.

.2 Supply new analog output card onto the existing 5/6 PLC backplane, located in the lower half of the existing FDP-W6 enclosure.

.1 Manufacturer: Schnieder Electric (Telemechanique)

.2 Platform: M340

.3 Recommended module: BMXAMO0410

.4 Card to be compatible with the existing PLC system

.1 Existing CPU part number: P342020

.2 Existing Power Supply part number: CPS2000

.5 Minimum 4 outputs

.3 No alternates or substitutes for manufacturer and platform will be accepted.

Part 3 Execution

3.1 HARDWARE INSTALLATION

.1 Install the PLCs And RIOs as per manufacturer instructions and recommendations and as shown on the Drawings.

.2 The Contractor to install the new I/O card and the City will provide HMI and programming modifications.

.3 Following is required for The City to complete the modifications:

.1 A minimum of 3 weeks advance notice that modification will be required.

.2 Contractor to provide I/O list.

3.2 PLC COMMISSIONING SERVICES

.1 Provide all required PLC commissioning services as per Sections 019113 – General Commissioning Requirements and 40 80 00 – Automation Commissioning.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 All control panels shall be built by a CSA/cUL-approved manufacturer and shall bear the CSA/cUL seal with the manufacturer's file number.

.2 All control panels shall be factory assembled and pre-wired. The control panel wiring shall be verified at the manufacturer's factory and completely tested before being shipped to the site.

.3 Supply, install, wire, and test all components inside the control panels according to the Specifications herein and the Drawings. All new panels shall be factory assembled and pre-wired. Factory Acceptance Tests (FATs) and System Integration Functional Tests (SIFTs) as per Division 40 61 21 shall be performed and witnessed and accepted by the Contract Administrator prior to shipping any panels.

.4 Any panels that are substantially modified from the original installation shall be inspected by an authorized CSA/cUL inspector and have a new CSA/cUL mark applied. Perform any required updated to substantially modified panels to meet the CSA/cUL requirements.

.5 Provide materials and fabrication of custom control panels as indicated and in compliance with the Contract Documents.

1.2 REFERENCES

.1 Comply with latest edition of the codes and standards applicable and/or referenced in Related Sections:

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

1.3 SUBMITTALS

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

.2 For each component and material submit Shop Drawing which shall include:

.1 Schematic diagrams shall show the equipment serial or tag number, the City's drawing number, contract number, or similar identification which will indicate the particular equipment to which the diagrams apply. Diagrams shall show all equipment in the electrical system including internal wiring of subassemblies. Diagrams of subassemblies may be furnished on separate sheets.

.2 Wiring and interconnection diagrams shall show all wire connections to device terminals, terminal blocks, and all wiring within the panel. No more than two wires shall be shown connected to any one terminal. Terminals shall contain unique identifiers. All signals shall be able to be fully traced on the Drawings.

.3 Identify each device by a unique number or number-letter combination.

.4 Detailed loop diagrams of connections to devices supplied as part of the skid and interconnections to City supplied infrastructure (motor starters, PLC panels).

.5 Show spare contacts.

.6 Panel Layout drawings.

.7 Complete Bill of Materials

.8 Configuration/parameter sheets including switch settings, parameter settings, and addresses. Show factory default settings and proposed settings.

.9 Diagram showing dip switches, complete with proposed settings.

.3 Submit Shop Drawings for approval prior to panel fabrication.

.4 Keep updated red line drawings of each panel in each control room during installation.

.5 Provide As-Built Drawings of the panel at the end of the project including: panel layouts, panel power distribution schematics, and detailed loop drawings.

.1 As-Built Drawings to adhere to the City of Winnipeg CAD Drafting Manual, Drawing Content Standard, and the WWD CAD/GIS Standards.

.6 Prior to construction:

.1 Submit product datasheets for review and approval of the Contract Administrator prior to construction of the control panels.

.2 Submit stamped red-line mark-ups of the proposed modifications to the control panels. If significant modifications are proposed/required, the sealed Tender Drawings (included in this package) in AutoCAD format will be supplied to the Contractor for revision and reference.

.7 Prior to shipment:

.1 Submit electronic pictures of enclosure exterior and interior, including door interior.

.1 Pictures to be of sufficient resolution to read component labels.

.2 As-built drawings:

.1 Submit as-built drawings. Minor changes may be made via red-line mark-ups.

.2 Draft significant changes on AutoCAD drawings.

.3 Submit panel FAT report to Contract Administrator for review.

.4 Do not ship control panel until approval from the Contract Administrator is received.

.8 Provide spare parts as described in Part 3.5 and in accordance with 01 78 00 – Closeout Submittals.

1.4 GENERAL

.1 All panel instruments and equipment shall be wired out to terminals, with the exception of direct connected instruments (thermocouples, strain gauges, analyzers, etc.). Contractor shall supply service power feeds and interconnections to the control panels.

.2 Run all conductors inside horizontal or vertical wireways. Instrument cases shall not be used as wireways or junction boxes.

.3 The fabrication procedures described herein are for conventional style control panels or panel consoles located in unclassified areas as a stand-alone unit or as part of a group of panels and racks. Panels located in hazardous areas must be provided with all additional necessary components and construction required to be certified to suit the environment in which they are installed.

.4 Panel and rack mounted instruments that may be damaged during shipping shall be removed and packed in their original shipping cartons. They shall be clearly marked with instrument tag number, panel number, and the package Vendor's purchase order number.

.5 The panel or panels shall be tested and certified report prepared by the Vendor and witnessed by Contract Administrator, if requested for the following:

.1 High potential and low potential ground fault check of all electrical circuits as per CSA requirements.

.2 Functional check of all instrument loops, alarm circuits, and controls to verify correct operation of all components. Simulated inputs and outputs shall be used for this checkout.

.3 Where circuits cannot be functionally tested, each wire shall be tested for continuity.

.4 Calibration of the process readout of indicating recording and control devices and setting of pressure switches and alarm or safety devices.

.5 Pneumatic tubing leak test of 40 psig. (Pressure shall not be applied to instrument internal components during this testing.)

.6 Panel clean-up to remove all traces of construction soiling and touch-up of paint scratches.

.6 Contract Administrator reserves the right to witness any or all of the above tests.

.7 The inspection program requirements of ISO 9000.4 shall apply.

1.5 QUALITY ASSURANCE

.1 Provide in accordance with Section 01 45 00 Quality Check.

1.6 INSPECTION

.1 A factory inspection of the control panels will be performed at the discretion of the Contract Administrator based upon the pre-shipment submittals.

.2 Demonstrate and test the control panel in the presence of the Contract Administrator’s designated representative as part of the FAT and SIFT/as required.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Transportation method to Site shall be in an air ride van or equivalent.

1.8 EQUIPMENT IDENTIFICATION

.1 Each Panel shall be tagged with lamacoid labels on the panel backboard where visible after wires are connected.

.2 Each panel shall have a CSA certification nameplate.

1.9 WARRANTY

.1 The Contractor shall warrant that all materials and equipment furnished under the Contract are in good working order, free from defects, and in conformance with system specifications. All installed equipment shall conform to the manufacturer’s official published specifications. The warranty shall begin at the system acceptance date and remain in effect for a period of one years from that date. The Contractor shall agree to repair, adjust, and/or replace (as determined by the Contract Administrator to be in its best interest) any defective equipment, materials, or other parts of the system at the Contractor's sole cost. The City will incur no costs for service or replacement of parts during the warranty period of five (5) years. All third-party warranties shall be passed through from the Contractor to the City.

.2 The Contractor shall warrant and supply evidence that the installation of materials and hardware will be made in strict compliance with all applicable provisions of the Canadian Electrical Code.

.3 The Contractor shall warrant that the system and individual parts will function in accordance with the manufacturers' published technical description guide.

1.10 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 enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

Part 2 Products

2.1 GENERAL

.1 Construct the control panels in accordance with the supplied Drawings.

.2 Control devices of each category shall be of same type and manufacturer.

2.2 ENCLOSURES

.1 Design and test control enclosures in conformance with C22.2 No286.

.2 Enclosure types shall be as follows unless noted otherwise in the Drawings or Specifications:

.1 Indoor use, non process area: NEMA Type 1.

.2 Outdoor use or process area: NEMA Type 4.

.3 Outdoor where ventilation is required: NEMA 3R with filters

.4 Corrosive area: NEMA Type 4X.

.3 All enclosure angles and cut-outs shall be free of dents, gouges, or weld marks and shall present a clean, smooth appearance.

.4 No screws, fittings, or other fastenings shall be used on external panel faces, which must be free of any marks, scratches, or defaults.

.5 Paint:

.1 The exterior of the control panel shall be painted ANSI 61 grey.

.2 The interior of the control panel shall be painted gloss white.

.6 Provide panels with front access only.

.7 Enclosure construction shall be minimum 14 gage steel complete with necessary stiffening to form a rigid free-standing lineup. Finish shall be white enamel inside and gray prime outside over phosphatized surface. Provide removable top and bottom cable entry plates.

.8 For panels within electrical rooms, the panel face shall be fabricated from commercial rolled steel with a gauge thickness sufficient to give structural rigidity to the finished panel. The minimum plate thickness allowable is 5 mm.

.1 Fabricate sides and top from 11 gauge cold rolled steel.

.2 Fabricate doors and removable panels from 14 gauge cold rolled steel.

.3 Auxiliary rack design shall be as shown on the City's Drawings giving the general layout, dimensions, and equipment numbers.

.4 Construction shall be 38 mm x 38 mm x 7.4 mm steel angle with 16 gauge cold rolled steel top and sides. Racks are to be rigid, self-supporting and capable of being lifted without deforming. Provide removable lifting lugs.

.9 Panel shall be of all welded unit construction with all corners fully welded and shall be reinforced with additional members as required to prevent buckling or distortion of the frame or the panel face due to normal handling during transportation and final assembly. The structures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors.

.10 Where free standing panels are specified, each panel section shall not require any external bracing, supports, or place any load on adjacent panel sections after assembly. Side members of adjoining panel sections shall have matching bolt holes on 30 mm centres for the full height of the panel.

.11 Slotted bolt holes shall be provided to fasten the panel to the bottom curb or channel base. Care shall be taken that the weight of each section is carried by the framework, and not by the bottom edge of panel face.

.12 Removable lifting eyebolts shall be provided for ease of handling and installation. Provide gasketed bolts to plug the threaded opening.

.13 Control panels shall be provided with insulation, heating, ventilation, and/or cooling as required to ensure the internal temperature and humidity are maintained at acceptable levels for the components within while still maintaining the required environmental ratings against humidity, corrosion, and/or hazardous areas.

.1 Perform a heat-load analysis for all control panels containing heat-generating components. Determine if the thermal dissipation via the enclosure walls is sufficient or if additional cooling is required. If additional cooling is required, consider installing filtered louvers at opposite corners of the control panel to provide cooling through natural convection. If natural convection is insufficient, install a filtered fan unit to provide forced air flow through the panel.

.2 Where fans are provided on control panels, ensure that the fans positively pressurize the cabinet to prevent ingress of contaminants through small openings. The air used to positively pressurize the cabinets must be from a clean source.

.14 Where heating from control devices results in a temperature rise which is detrimental to the contained equipment or its operation, provide louvers or forced air ventilation. Design ventilating openings to prevent the entrance of any deleterious substance. When forced air ventilation is required, the cabinets shall be pressurized. Air filters shall be of commercially available types and sizes.

.15 The depth of the control enclosure or compartment shall be a minimum consistent with the maximum depth of the control devices plus the required electrical clearance. In no case shall the depth of the enclosure be less than 200 mm.

.16 Provide interior mounting panel for mounting of interior components. Mounting panel(s) shall be three (3) mm thick steel and shall be painted with one (1) coat of primer and one (1) coat of white baked enamel.

.17 Provide a permanent metal data pocket attached to the inside of the enclosure. If space permits, the pocket shall be at least 250 mm wide and of depth and thickness to accommodate electrical diagrams.

.18 Doors:

.1 The door is to be a minimum 14 gauge steel plate, full height, and flush with adjacent surfaces.

.2 All control panel doors shall be 900 mm (36 inches) wide maximum.

.3 All control panel doors shall open through 180 degrees without restriction.

.4 Doors shall be key lockable and fitted with 3-point heavy duty latching assemblies. Access doors and covers shall be provided with lockable handles. The necessary hardware shall be supplied with keys to a master system.

.5 Provide hasp and staples for padlocking.

.6 Provide a continuous piano hinge with external screw clamps and a pneumatic hold open device on each door.

.7 Provide sealing gaskets for all doors suitable for the operational requirements of a gas-purged panel.

.19 Install lamacoids.

.20 Each instrument, indicating or control device on or behind the face of the panel shall be identified with its tag number and shall have its function described by means of an individual laminated plastic nameplate. Nameplates shall be of the format indicated in 26 05 00. Nameplates shall be permanently and securely attached to panel base. Self-tapping screws shall not be used to attach nameplates. The use of corrosion resistant machine screws with nuts and lock washers is acceptable.

.21 Manufacturer:

.1 Hoffman

.2 Rittal

.3 Hammond

.4 Or approved equal.

2.3 PURGE SYSTEM

.1 Refer to Section 23 21 00 – Sludge Pump Hydraulic Powerpack

2.4 INSTRUMENT AIR

.1 The air supply header shall be NPS 2 sch. 40S 316L stainless steel pipe and shall run the entire length of the panel. Galvanized unions shall be provided between panel sections. Air supply lines shall be run from the top of the header for each instrument requiring air. Each line shall have its own shut-off valve. Fifteen percent spare connections complete with shut-off valves shall be provided. An air header drain valve shall be provided on the underside of the header. Slope air header down approximately 1 mm per 100 mm in the direction of air flow. Provide NPS 1/2 valved blowdown and drain connection at the low end. Install a pressure gauge and a low-pressure alarm switch to monitor header pressure.

.2 Instrument air to the header shall be filtered and reduced by a dual filter regulator system, piped and valved in parallel, sized to provide 150% of air requirements for all the panel instruments. Filters to be cartridge type. Pressure relieving device to be set at 25 psig.

.3 When stainless steel tubing is specified, it shall be 1/4" O.D. x 0.035" wall. When plastic tubing is specified, it shall be 1/4" O.D. x 0.040" wall, virgin polyethylene approximately 0.925 density. The following indicates tube colour coding and tagging for various services:

Color Code	**Tagging**
Air Supply- Red	AIR
Transmitted Signal- Orange	XMT
Controlled Signal- Yellow	CTL
Pneumatic Set Point- Black	SET
Alarm Signal- Green	ALM
All Other Signals- Natural	OTH

.4 Tubing which is to connect with field runs shall terminate at bulkhead fittings on a bulkhead plate located for ease of access when connecting field tubing. 15% spare bulkhead fittings shall be provided on each bulkhead plate. All terminations shall be tagged with instrument tag and shall be coded as shown above.

2.5 POWER SOURCE

.1 Each power source must be protected by a CSA approved circuit breaker or fuse.

.2 The location of each power source must be clearly shown.

.3 Panels powered by more than one (1) electrical source shall display on their door; ”Caution: This panel is electrically powered by more than one source”.

2.6 COMPONENTS

.1 Unless written approval for use of unapproved components is received from the Contract Administrator, all electrical materials (e.g., conduit, fittings, wireways, etc.) shall be CSA or cUL approved.

.2 All components are to be DIN Rail Mounted.

.3 Identification tags shall be preprinted white heat-shrinkable tubing, Raychem Thermofit TMS or equivalent.

.4 Control Wiring

.1 120-volt control wiring shall be Type MTW, THWN, or THHN. Conductors shall not be smaller than No. 14 AWG. Ampacity shall be in accordance with the CEC.

.2 Instrumentation signal cables shall be of the type used for field wiring.

.3 Wire and cable insulation shall be flame retardant.

.4 High flexible stranding type wire shall be used in restricted spaces or across hinged sections.

.5 Wire colour to follow the City of Winnipeg’s Automation Design Guide, Electrical Design Guide, and Identification Design Guide.

.5 Internal Wiring

.1 Panel wiring shall be neatly contained in narrow-slot ventilated wireways with covers, including incoming and outgoing field control wiring.

.2 Wireways:

.1 Shall be light gray coloured, restricted slot design, with matching snap-on covers. Use light blue coloured wireways for intrinsically safe wireways.

.2 Provide wireways with mounting holes and nylon "push" rivets for mounting. Wireways material shall be PVC or noryl.

.3 Size wireways such that they are not more than 40% full once the wiring is installed.

.3 Wiring Duct

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or approved equal in accordance with B7.

.2 Wiring duct shall be installed on both sides of the panel and between the DIN rails.

.3 Wire or cable, connected to internal device or arriving from external device, shall be uncovered by wiring duct for a maximum of 10 cm.

.4 Provide the mandatory ventilation clearances around heat-generating components as specified by the component manufacturer. Indicate mandatory component clearances on the panel layout drawings.

.5 Provide a minimum of 19 mm separation between ventilated wireways containing intrinsically safe wiring and ventilated wireways containing non-intrinsically safe wiring.

.6 Tie wiring run to control devices on the front door together at short intervals and secure to the inside front door with adhesive mounts. Mounts shall be adjustable releasable-clamp type for wire bundles 17 mm in diameter or smaller or releasable nylon cable ties for bundles larger than 17 mm in diameter. Attach mounts to front panel with adhesive.

.7 All conductors shall be securely fastened to terminals at both ends; no splices are allowed inside the panel.

.8 All analog twisted pair wiring shall be 18 AWG shielded such as Belden No. 8760 or approved equal in accordance with B7. Shield wires exiting the jacket must be covered with a black heat shrink and the overall cable at the jacket end must also be covered with a heat shrink.

.9 All 24 VDC or 120 VAC discrete signal wiring shall be 16 AWG TEW stranded conductor.

.10 All 120 Vac power wiring shall be 14 AWG TEW stranded conductor, minimum.

.11 All 24 Vdc power wiring shall be 12 AWG TEW stranded conductor, minimum.

.12 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.13 The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door such that there is sufficient slack to minimize strand fatigue and breaking. Each end of the loop shall be properly supported.

.14 Wire ties shall be non-metallic.

.15 Wiring shall be arranged to be readily accessible for inspection and maintenance.

.16 The wiring arrangement shall not interfere with access to panel-mounted devices or spaces for future equipment.

.17 The routing of all analog, digital, power, and networking wiring and cabling inside control panels shall be segregated as much as possible by the type of signal they are carrying. Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes.

.18 Categorize and group conductors based on their application. Provide separate wireways for conductors of each category in order to minimize electromagnetic interference. Categories 3 and 4 may be combined if space is limited.

.1 Category 1: AC Power and Control:

.1 AC Power for power supplies.

.2 120 VAC Control Wiring.

.3 24 VAC Control Wiring.

.2 Category 2: DC Power and Control:

.1 DC Power

.2 DC Control Wiring

.3 Category 3: Analog Signals

.1 Analog I/O

.4 Category 4: Communications:

.1 Communication Cables

.19 The AC signals shall be separated into different wireways for each of the following categories:

.1 UPS system - 120 V AC, 60 Hz maximum

.2 Frequency continuous pulses (turbine flow metering).

.3 Motor control and motor status lights.

.4 120 V AC, 60 Hz utility power.

.20 The DC signals shall be separated into different wireways for each of the following categories:

.1 Low level analog signals 100 mV maximum voltage level (thermocouples and strain gauge output signals).

.2 High level analog signals, 100 mV - 90 V (4-20 mA DC, 0-5 V DC, RTD's).

.3 Digital intermittent pulses, low level energy (computer data).

.4 Other DC signals (on-off control, alarm, or instrument power).

.5 If intrinsically safe instrument systems enter the panel a further segregation of the above voltage levels shall be observed. Separate the intrinsically safe system from the non-intrinsically safe system. Provide wire connections to terminals for termination of field wiring. Use point to point wiring inside the panel. Use one continuous wire from point to point, no splices are permitted.

.6 For 24 V DC on-off logic, annunciation, and indicating lights use wire with following properties:

.1 CSA approved for 300 V

.2 18 or 16 AWG stranded copper conductor.

.3 90°C minimum temperature rise, flame retardant insulation.

.7 For power supply (to single instrument) use wire with the following properties:

.1 CSA approved for 600 V

.2 14 AWG stranded copper conductor.

.3 90°C minimum temperature rise, flame retardant insulation and/or instrument cord sets supplied by others.

.4 Select ampacity from the 75°C operating temperature column.

.8 For analog signals, digital intermittent pulse and frequency continuous pulses use instrumentation with the following properties:

.1 CSA approved for 300 V.

.2 20 AWG stranded copper conductor.

.3 Twisted pair construction with 50 mm nominal lay.

.4 PVC jacket.

.6 Rails (DIN Rails)

.1 Rails used must be DIN Rail style TS 35mm, slotted.

.2 When used to mount terminals, rails shall be mounted on straight raisers (rail support / mounting feet) so as to raise them to the same height as the highest adjacent wiring duct.

.3 Raisers (rail support / mounting feet) shall not be used when rail hosts heavy components.

.7 Terminals

.1 Requirements:

.1 TS-35 DIN Rail mounting.

.2 Voltage rating:

.1 600V for general control circuits.

.2 600V for power circuits.

.2 Terminal blocks shall be designed for the size of the wires to be connected to them.

.3 Ground Terminals shall be electrically grounded to the mounted DIN rail.

.4 Terminal blocks used for analog, digital, and power cables shall be identified and physically separated from each other.

.5 Each terminal shall bear an identification number on both sides.

.6 Drawings and templates supplied may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc. The Contractor must supply and install such components when required.

.7 Provide fifteen (15) spare terminal blocks of each type for the project.

.8 Provide enough terminal blocks for designed requirements including indicated spares. Wire all spare terminal blocks back to PLC or RIO cards.

.1 One terminal block shall be provided for each wire entering or exiting the control panel.

.2 No more than two wires shall terminate on the same terminal.

.9 Provide screw clamp compression terminals in style shown on Drawing.

.10 Terminals shall be color coded as follows:

Colour	**Code**
Red	+ 24VDC
Black	0VDC common, Analog Signal Common
White	VAC neutral
Grey	120VAC
Green	Ground
Yellow	Shield

.11 Approved manufacturers:

.1 Phoenix Contact

.2 Weidmueller W Series

.8 Grounding

.1 Provide grounding lugs for each panel, suitable for termination of up to #2 AWG copper grounding conductor.

.9 Ground Bus Bar

.1 Supply a ground bus bar in each control panel. Provide Electrical and Instrumentation ground bus bars for each panel. Connect Electrical and Instrument ground bus bars at circuit location nearest the panel external ground connection.

.2 Connect only instrument grounds to the Instrument Ground bus bar.

.3 Requirements:

.1 Tapped holes with screws.

.2 Bar to have sufficient connection points for all cables entering the control panel, plus 25% spare.

.3 Maximum one wire termination per screw.

.10 Supply Circuit Disconnecting Means

.1 Provide a supply circuit disconnect for each control panel. Disconnect shall be a circuit breaker/fused disconnect/disconnect mounted within the control enclosure operated by a variable depth flange-mounted circuit breaker operating mechanism.

.11 Overcurrent Protection

.1 Panel-mounted devices and all control circuits shall be protected by appropriately sized fuses or circuit breakers.

.12 Power Supplies

.1 Provide all DC power supplies as required for all instrument circuits. Power all circuits from the local control panels or marshalling panels. Power supplies to be complete with an overvoltage protection module.

.2 Provide redundant configurations for power supply equipment serving more than one instrument loop, so that failure of a single unit will not disable all or any shared part of the instrumentation and communication system. Provide diode isolation for redundant direct current supply units and ground the negative terminal of the power supply.

.3 Unless otherwise required, all DC power supplies to be rated 24 VDC, adjustable ±20%, and set to provide 24 V on the panel direct current bus. Size the power supply for two times the connected load, minimum size is 2 amps.

.4 Approvals: CSA.

.5 Input: 100-240 VAC, 45-65 Hz.

.6 Output: 24VDC.

.7 Mounting: NS 35 DIN rail.

.8 Manufacturer and series:

.1 Phoenix Contact, TRIO-UPS-2G/1AC/24DC/10,

.2 Sola,

.3 Hammond

.4 GFC

.5 Or approved equal in accordance with B7.

.13 Pushbuttons, Switchs, and Indicator Lights

.1 When required, all control panel pushbuttons, switches, and indicator lights shall be at least NEMA 12 (or better)-type devices.

.2 Manufacturer:

.1 Schneider Electric Type K or SK

.14 Pilot Light

.1 Push to test type

.2 Manufacturer:

.1 to be Schneider Electric Type K or SK

.15 General Purpose Relays

.1 Type: DPDT or as shown on Drawings.

.2 Indication: LED.

.3 Coil voltage: As per Drawings.

.4 Contact rating: 5A (120 VAC), 5A (24 VDC).

.5 Provide diode suppression for DC coils.

.6 Socket mounting: 35mm DIN rail

.7 Approvals: CSA.

.8 Manufacturer:

.1 Omron,

.2 Finder

.3 Phoenix Contact PLC-RSC Series.

.16 I/O Relays

.1 Relay interface for PLC Discrete Inputs, 1PDT :

.1 Coil rating: 3.5 mA at 120 VAC.

.2 Contact material: Gold-plated silver tin oxide alloy.

.3 Contact switching voltage: 36 V dc max.

.4 Contact minimum switching current: 1 mA.

.5 Contact maximum inrush current: 50 mA.

.6 Wire Size: 26 to 14 AWG for both input and output side.

.7 Color: Gray body.

.8 Width: 6.2 mm.

.9 Bridging: Plug-in bridge.

.10 Approvals: cULus

.11 Standard of acceptance: Phoenix Contact 2966281.

.2 Relay interface for PLC Discrete Outputs, 1PDT :

.1 Coil rating: 9 mA at 24V dc.

.2 Contact material: Silver tin oxide alloy.

.3 Contact switching voltage: 5V ac min, 250 V ac max.

.4 Contact limiting continuous current: 6A.

.5 Wire Size: 26 to 14 AWG for both input and output side.

.6 Color: Gray body.

.7 Width: 6.2 mm.

.8 Bridging: Plug-in bridge.

.9 Approvals: cULus

.10 Standard of acceptance: Phoenix Contact 2966171.

.17 Analog Signal Isolators:

.1 Provide galvanic isolation between analog signals where not already provided by the programmable logic controller or other components.

.2 Input: 0-5V, 1-5V, 0-10V, and 4-20 mA (switch selectable).

.3 Output: 4-20 mA.

.4 Channels per isolator: 2 or 4.

.5 DC input resistance:

.1 Current inputs: 50 Ω.

.2 Voltage inputs: 1 MΩ.

.6 Performance:

.7 Features:

.1 Output ripple: < 10 mV peak-to-peak measured across a 250 Ω resistor.

.2 Isolation: 1000V rms input-to-output and channel-to-channel.

.3 Common mode rejection: > 95dB @ 60 Hz, 500V rms maximum.

.4 Adjustable zero and span for each channel via potentiometers.

.5 Removable wiring connectors.

.8 Environmental:

.1 Temperature range, operating: -40 to 70 degrees Celsius.

.2 Relative humidity, operating: 0 to -95 percent non-condensing.

.3 Ambient temperature effect: plus or minus 0.015 percent of span/ degrees C maximum.

.9 Manufacturers:

.1 Acromag,

.2 Moore Industries,

.3 MTL Instruments,

.4 Phoenix Contact.

.5 Or approved equal in accordance with B7.

.18 Signal Conditioning Module

.1 Where required, provide signal conditioning modules which comply with the following requirements:

.1 Analog signal inputs: 4-20 mA DC into 500 ohms or less.

.2 Analog signal outputs: 4-20 mA DC into 500 ohms.

.3 Discrete output contacts: SPDT or DPDT rated 5A.

.4 Arrange electronic trips so that output contact opens in case of loss of signal or loss of power supply.

.5 Signal conditioning and isolating modules to be rated for continuous operation in an ambient temperature of 0 to 80°C. The ambient

temperature effect on module accuracy is not to exceed plus or minus 0.01% per °C within that range.

.6 Span and zero adjustments to be made by front accessible multi-turn potentiometers.

.7 Provide electronic trip modules with LED indicators for relay status.

.8 Signal conditioning modules to withstand 30 V per meter radio frequency radiation between 200 and 500 MHz with not more than 0.25% calibration effect. Provide modules with traps on the terminals to shunt conducted radio frequency interference to ground.

.9 Provide effective isolation of signal and power supply terminals from the case.

.19 Internal Lighting

.1 All control panels of a depth greater than or equal to 300 mm shall be equipped with a lighting device with a door switch. Whenever the door is opened, the lighting system shall automatically be activated.

.2 Fixture mounting: top-centre of enclosure, unless otherwise noted.

.3 Lights: LED, white.

.4 Power supply: 24 VDC.

.5 Manufacturer:

.1 Hoffman,

.2 Or approved equal in accordance with B7.

2.7 SPARE PARTS

.1 Provide ten (10) spare fuses for each panel of each rating type. Store in resealable plastic bag inside panel document holder.

Part 3 Execution

3.1 GENERAL

.1 Construct panels in conformance with C22.2 Number 286.

3.2 WIRING

.1 Wire panels as shown in the contract drawings and as per the Shop Drawing.

.2 No splices shall be used while wiring the panel.

.3 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the panels.

.4 Provide minimum 50 mm of clearance between wireway and any point of wire terminations to allow for clear viewing of wire identification marking.

3.3 COMPONENT INSTALLATION

.1 Components on the front of the panel shall be identified with an individual permanent nameplate installed in an organized manner. The nameplate must identify the component’s function.

.2 Each component inside the control panel shall be identified with a nameplate corresponding to the Drawings.

.3 All non-DIN rail mountable devices in the control panel shall be mechanically affixed to the back panel with either tapped or self-tapping screws.

.4 All control devices shall be mounted so that any component can be replaced without removing the sub-panel or other components.

.5 Components and/or auxiliary instruments mounted at the rear of the panel shall be readily accessible and their installation shall not be affected by, or interfere with, the removal of any panel instrument.

.6 Nameplates shall be made of hard plastic lamacoid material with a white background and engraved black letters for internal and external components. Refer to section 26 05 00 Common Work Results for additional requirements.

.7 Supply and install all required fuses.

.8 Control devices must be spaced adequately to allow for cooling, replacement, servicing, and wiring access.

.9 Control devices shall be grouped according to voltage and function to reduce electrical noise.

.10 Cutouts for instruments shall be within the tolerances specified by the instrument manufacturer.

.11 If cutouts are specified for future instruments, the cutouts shall be covered by removable steel plates 3 mm (1/8 inch) thick. The cover plates shall be finished and painted with the same paint as applied to the front panel.

.12 If any panel-mounted item is not available for installation before the panel is scheduled for shipment, wiring from the terminal block to the panel location for the item shall be completed, wire ends shall be formed exactly to the configurations required, and identifying sleeves shall be applied, ready for connection.

.13 Panel areas designated for future equipment shall be kept clear of stiffening members, rear-mounted equipment, wiring, and all other interferences.

.14 Ample space shall be provided for the entrance of external cables into the panel and for routing the cables to terminating points within the panel.

3.4 GROUNDING

.1 All control panel components shall be adequately grounded in accordance with the component manufacturer’s instructions, especially control system components.

.2 Bond all devices to the panel ground bus bar.

.3 Provide a ground system for the instrumentation circuits, isolated from the main power system ground to each marshaling panel.

.4 Firmly bond all panel mounted devices on or within the panels to ground. Provide supplementary bonding conductors for backpanels 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.

3.5 TERMINALS

.1 Jumper bars shall be used where possible in lieu of jumper wires.

.2 Provide sufficient terminals so that not more that 2 conductors are connected under the same terminal. Provide 20% spare terminal capacity at each terminal block assembly.

.3 All internal panel conductors shall be connected to the same side of a terminal block and external conductors to the other side. The only exception is for fused terminals which require connection to the field side for internal wiring.

3.6 IDENTIFICATION

.1 Plainly and permanently identify control and power devices using the same identification as shown on the schematic diagrams. Show identification for devices inside the enclosure on a plate adjacent to, not on, the device.

.2 All wires and cables inside the control panels shall be identified on both ends using permanent labels. Labels shall be machine printed; handwritten labels shall not be accepted. Utilize heat shrink labels where practicable. Allow approximately 50 mm of wire insulation between tag and the bare wire.

.1 Wire labels shall match the drawing labels.

.2 Wire terminations and connections shall match the Drawings and schematics.

.3 All individual conductors shall be labelled.

.3 Identify wire terminations with a number to correspond with the schematic diagrams.

.4 Identification for wire shall be in accordance with the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels. Wrap-around or self-adhesive markers shall not be permitted.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.5 Individual conductors or wires exiting a cable shall be identified using wire and cable tags, with printed labels.

.6 Perform terminal identification using a computerized device. Handwriting is not acceptable.

.7 Label terminals as shown on Drawings.

.8 Install label above each terminal block with terminal block name, defined as follows:

.1 Wire identification to use the connected field device tag name with the wire's corresponding 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 indicating transmitter PIT-DP001A, located in the field has a 2CTPSH 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 PIT-DP001A all the way to the marshalling panel.

.4 Identify spare wires by using the destination identifier, i.e., the location and terminal identifier of the opposite end of the wire are combined to form the wire tag.

.5 Arrange wiring on terminal blocks such that all internal panel wiring terminates on the inboard side of the terminal block and all external wire connections are made on the outboard side.

.9 Provide nameplates for each device on or within the panels and enclosures. Size of nameplate shall be as indicated in 26 05 00 Common Work Results. Securely fasten nameplates in and situate them in a visible location.

.10 Every cable entering or leaving the enclosure shall be labelled with permanent marking identification subject to review by the Contract Administrator prior to use.

3.7 TESTING

.1 Perform Factory Acceptance Tests and System Integration Functionality Tests as specified in 40 61 21.

.2 Testing of the control panels shall be completed to the greatest extent possible prior to the FAT and shall include at minimum:

- .1 Provide a signed and dated inspection sheet with all tests performed listed on it.
- .2 The list of the various test procedures described hereunder is not restrictive and does not relieve the Contractor of his responsibility to perform any other work that is not mentioned but requested to verify the good operation of the control panels.
- .3 Isolate all instruments and components of the control panels as required to protect them from any damage during tests.
- .4 Provide the services of qualified personnel as well as tools and equipment required to perform all tests and inspection of the control panels.
- .5 Tests to include:
  - .1 Power supply functionality,
  - .2 PLC and RIO component (processors and cards) functionality,
  - .3 Point to point tests of all inputs and outputs,
  - .4 Power terminal voltage verification,
  - .5 Relays and switches functionality,
  - .6 Receptacle functionality,
  - .7 Lighting functionality,
  - .8 Networking functionality (including both PLC networking and switch networking capabilities),
- .6 If the panel is modified after tests have been performed, tests shall be repeated.

3.8 INSPECTION

.1 Inspect all panels after delivery to ensure no signs of damage from transportation. Inspect wires for loosened terminations.

.2 Notify the Contract Administrator and replace any component damaged in transportation.

3.9 SHIPMENT

.1 Request for shipment of any panel having shortages of equipment is subject to approved in writing by the Contract Administrator. The Contract Administrator has sole discretion on either granting approval or not granting approval for shipment.

3.10 SPARE COMPONENTS

.1 Supply two spares of each fuse type and rating. Place in a clear plastic bag and attach to the panel door interior.

END OF SECTION

Part 1 General

1.1 COMMISSIONING

.1 In cooperation with the Contract Administrator, perform extensive commissioning and startup functions to verify the operation of all of the systems described herein as the installation in completed. Cooperation will be required to facilitate the timely performance of these activities. The Commissioning Team, under the direction of the Contract Administrator, will coordinate and schedule all activities associated with commissioning and start-up, and the Contractor shall cooperate and arrange its schedule of the Work to facilitate the timely performance and completion of this work.

.2 Commissioning and handover of the facilities will comply with the requirements in Division 01.

.3 Carry out commissioning under direction of the Contract Administrator and in the presence of representatives of the Contract Administrator and the City.

.4 Submit commissioning plans and schedules a minimum of two (2) months prior to testing.

.5 Inform and obtain approval from the Contract Administrator in writing at least 14 Calendar Days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures and anticipated results.

.3 Names of testing/commissioning personnel.

.4 City personnel requirements to assist with commissioning.

.6 Correct deficiencies and re-test until satisfactory performance is obtained.

.7 Acceptance of tests will not relieve the Contractor from their responsibility of ensuring that complete systems meet every requirement of the Contract.

.8 Perform tests as required.

1.2 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by the Contract Administrator.

1.3 REFERENCES

.1 Comply with latest edition of the codes and standards applicable and/or referenced in Related Sections:

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

1.4 SUBMITTALS

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

.2 Submit commissioning test plans, procedures and commissioning forms, in writing, at least 31 Calendar Days prior to commissioning.

.3 Submit Final Automation Commissioning Report as described in Part 1.6 of this specification.

1.5 COMMISSIONING FORMS

.1 Sample commissioning forms will be provided with the tender. The Contractor is responsible for providing all required testing and commissioning forms including checklists, forms, and reports as necessary. Microsoft Word versions of the sample commissioning forms can be provided after contract award.

.2 Supplement the provided forms as required to make a complete commissioning report package.

1.6 SUBMITTALS

.1 Supplement submittal documentation as needed to provide adequate records of commissioning activities in accordance with accepted industry practice.

.2 Issue submittals for Contract Administrator review and acceptance in accordance with the project schedule as defined herein and in a timely manner to ensure that all required documentation is in place prior to the commencement of any testing or commissioning activities.

.3 Coordinate the submittals detailed in other sections of the specifications with the requirements defined in this section to achieve a complete set of documentation without overlap or gaps.

.4 Submit to the Contract Administrator the Final Automation Commissioning Report in accordance with the requirements of Section 01 78 00 – Closeout Submittals.

.5 The Final Automation Commissioning Report to:

.1 Include measurements, final settings, and certified test results.

.2 Include completed commissioning forms.

.3 Bear signature of the commissioning technician and supervisor.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments, and modifications as set during commissioning.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions, or energy consumption.

Part 2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system.

.2 Provide two-way radios for communication between field technicians.

.3 Test instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.4 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 6 months prior to tests.

Part 3 Execution

3.1 STATUS PRIOR TO COMMISIONING

.1 The commissioning activities described herein applies to all components and systems that make up the entire Process Control System for the work provided under this project.

.2 Prior to commissioning, ensure that the following is completed:

.1 Installation of all panels and completion of all wiring connections.

.2 Testing wiring for continuity from the field device to the control panel.

.3 Prior to commissioning and start-up activities, a series of operational tests will be performed by the Contractor, with the Contract Administrator in attendance, including, but not be limited to:

.1 Verification of correct transmission of signals to the receiving device.

.2 On completion of installation, check all controlling inputs and controlled outputs for individual correctness prior to activation of any line equipment.

.3 Subsequently, perform all equipment function operation and interlock checks prior to activation of any line equipment (dry run check).

.4 Finally, place all equipment online and energize for an actual controlled operation cycle.

.5 Complete any corrective action necessary that has been identified as part of the checkout procedure, on an ongoing basis.

.4 Provide a minimum of one qualified technician to test and commission the control system.

3.2 QUALIFICATION OF PERSONNEL

.1 The personnel performing the field tests and commissioning shall be experienced and thoroughly familiar with the apparatus and systems being tested and commissioned. They shall be capable of conducting the tests and commissioning activities in a safe manner, analyze the test data and make a decision on operability of specific equipment and system.

.2 The Contract Administrator shall witness the testing and commissioning.

.3 City of Winnipeg representatives shall observe the testing and commissioning.

3.3 PREPARATION

.1 Carry out all pre-commissioning activities as required herein.

.2 Coordinate all pre-commissioning schedules with the Contract Administrator.

.3 Keep accurate records of all works completed and submit final documentation for each pre-commissioning activity as and when completed for each portion of the project. Certify all final submissions as accurate and true.

.4 Review FAT (if conducted) and working copies of the construction documents to verify the condition is acceptable and suitable for commissioning.

.5 Prepare Commissioning Plan.

.6 Submit Commissioning Plan for review and approval by Contract Administrator.

.7 Coordination and schedule and manufacturer’s assistance as required.

.8 Provide any manufacturer’s instructions in the commissioning plans.

.9 Loop Checks:

.1 Perform loop checks to verify proper operation of all loops prior to commissioning.

.2 Check Documentation.

.3 Visually inspect the installation.

.4 Verify the loop functionality.

.10 Instrument system tests:

.1 Demonstration of operation of all equipment in all control modes as documented in the Process Control Narratives.

3.4 PROCEDURES

.1 Scope of the test includes hardware, software, programming, configuration, documentation etc.,

.2 Hardware, includes construction, visual inspection, wiring, labeling, agreement with Shop Drawing, requirements and acceptance criteria,

.3 Test each I/O point from the instrument to the PLC system.

3.5 COMMISSIONING

.1 Carry out all testing and commissioning activities as required herein.

.2 Coordinate all commissioning schedules with the Contract Administrator.

.3 Keep accurate records of all works completed and submit final documentation for each commissioning activity as and when completed for each portion of the project. Certify all final submissions as accurate and true.

.4 Reviewing commissioning plan;

.5 Reviewing pre-commissioning reports to verify acceptable condition for commissioning phase;

.6 Perform Loop Functional Checks;

.1 Demonstrate equipment functionality as described in the Commissioning Plan. Minimum requirements shall demonstrate all functionality in the Process Control Narratives and Specifications.

.2 For analog signals use 4-20 mA sources to simulate the transmitter signal. For Profibus instruments, use a handheld communicator connected at the transmitter to simulate the signal. For discrete signals, simulation includes the use of a jumper or lifting a wire/opening a fuse in the circuit.

.3 Simulate values at multiple points (in both increasing and decreasing directions) of transmitter span (0, 25, 50, 75 and 100%) to confirm the sensor/transmitter, HMI and any other indicators all agree.

.4 Simulate values above and below range to confirm failure reaction in PCS. Simulate a sensor/transmitter failure and/or disconnection to verify the failure reaction in PCS.

.5 Reconnect the transmitter to verify the device is automatically and correctly communicating with PCS. Final alarm and control set point adjustments as necessary;

.6 See Appendix N for loop check test form templates.

.7 Interlock Verification:

.1 Force each interlock initiator, one at a time, and confirming that all interlock actions occur at the proper trip points in accordance with the Process Control Narratives.

.8 During software commissioning and start-up, perform the manual or automatic activation of field devices. Confirm the integrity and functional operation associated with the wiring and equipment which is required to operate with the software systems provided.

.9 Adjustments of skid speed controller's PID value (Loop Tuning) as necessary;

.10 Support City of Winnipeg staff with field changes required for:

.1 Demonstration and monitoring of PCS diagnostic alarms;

.2 Verification of complex control schemes;

.3 Sequence logic checks including demonstration of all sequence logic and control loops as described in the Process Control Narrative. Force each sequence logic or control loop initiator, one at a time, and confirming that all logic actions occur properly in accordance with the Process Control Narrative.

.11 Monitor the control system performance for any system failures during testing and operation.

.1 System failures include but are not limited to server errors and warnings, and network health;

.12 Commissioning of analyzers, sample handling systems and other special instruments;

.13 Create a Commissioning report upon completion of all commissioning activities demonstrating and verifying all functionality as laid out in the commissioning plan. Include tests and demonstrations performed, measured values, system response, and tuned values.

.1 Submit Commissioning Report for Contract Administrator's review and acceptance.

.14 For those parts of the system outside of the scope of the City's PLC that are software programmable, perform software commissioning and start-up. Determine the sequence in which the software commissioning and start-up shall occur and coordinate the performance of software commissioning and start-up with the Contract Administrator.

.15 For software commissioning and start-up, include, but do not limit to:

.1 Process control strategy verification

.2 Operator interface device verification down to final control drives

.3 Annunciation system verification

.4 Systems power fail/restart testing to verify proper operation

.5 Verification of all trip, alarm, and display functions

.16 Conduct final verification of commissioning of all systems through actual operation of the various parts of the process as determined by the City and the Contract Administrator.

.17 Control System commissioning will be considered complete when, in the opinion of the Contract Administrator, the control system hardware or designated portion has properly operated for seven (7) continuous days, 24 hours per day without interruption. This 7-day period is in addition to any test periods or operational demonstrations specified elsewhere. The objective will have been achieved once it has been demonstrated that all systems are operating and have complied with the specified performance requirements herein.

3.6 CONTRACTOR REPRESENTATIVE

.1 Designate and furnish one or more Contactor personnel to coordinate and expedite all commissioning activities and documentation functions.

.2 Contractor representative(s) to coordinate all commissioning works carried out by specific equipment vendors in accordance with the commissioning planning and schedules submitted by the Contractor.

.3 Representative(s) to attend all meetings concerning the commissioning function as may be requested by the Contract Administrator. Representative(s) to be available at all times during the pre-commissioning, commissioning and performance evaluation phases of the project.

3.7 CONTRACT CLOSEOUT

.1 Provide in accordance with Section 01 78 00.

END OF SECTION