TECHNICAL SPECIFICATIONS

NEWPCC Boiler Replacement 2025-2026

Issued for Construction

2025-03-24

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 provided it does not disrupt performance of the City's normal operations. Refer to Appendix A for parking area designated for this project. 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.

1.16 SITE LAYDOWN AREA

.1 See Appendix A for details of the Contractor laydown area.

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 W - Training Requirements**

.2 In the event of discrepancies between this section and Appendix W, 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 the *Commissioning Plan* provided in Appendix B and this section.

.2 In the event of any discrepancies between this section and the commissioning plan, most stringent requirement shall be provided.

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 SCOPE OF WORK

.1 Supply and installation of the drainage piping as specified herein.

1.2 RELATED REQUIREMENTS

.1 07 92 00 - Joint Sealants

.2 23 05 15 - Common installation requirements for HVAC pipework

1.3 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM B 32-08, Standard Specification for Solder Metal.

.2 ASTM B 306-02, Standard Specification for Copper Drainage Tube (DWV).

.3 ASTM C 564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 CSA Group (CSA)

.1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.2 CAN/CSA-B70-06, Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CAN/CSA-B125.3-05, Plumbing Fittings.

.3 Green Seal Environmental Standards (GSES)

.1 Standard GS-36-00, Commercial Adhesives.

.4 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2020 (NPC).

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

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 datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Waste Management and Disposal.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground drains and vent Type DWV to: ASTM B 306

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.3

.2 Wrought copper: to CAN/CSA-B125.3

.2 Solder: to ASTM B 32

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground drain and vent: to CAN/CSA-B70

.1 Joints:

.1 Hub and spigot:

.1 Caulking lead: to CSA B67

.2 Mechanical joints:

.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 In accordance with Section 23 05 05- Installation of Pipework.

.2 Install in accordance with National Plumbing Code, Provincial Plumbing Code, and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: separate waste materials for reuse, and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Supply, installation, and commissioning of the new nitrogen system.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels.

.1 BPVC-VIII B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 1.

.2 BPVC-VIII-2 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.

.3 BPVC-VIII-3 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 3 - Alternative Rules High Press Vessels.

.2 ASME B16.11, Forged Fittings, Socket-Welding and Threaded.

.2 ASTM International (ASTM)

.1 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

.3 CSA Group (CSA)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

1.3 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 datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling, and unloading:

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

Part 2 Products

2.1 GENERAL

.1 Finish: Hi Pro Polyester, Painted or approved equivalent as per B8.

2.2 PIPING

.1 Piping: to ASTM A 53/A 53M, Grade B, schedule 80 seamless black steel

.2 Jointing Material

.1 NPS 2” (50 mm) and smaller: threaded.

.2 NPS 2 ½” (65 mm) and larger: butt welded.

.3 Fittings

.1 NPS 2” (50 mm) and smaller: to ASME B16.11, schedule 80 steel, threaded.

.2 NPS 2 ½” (65 mm) and larger: to ASME B16.11, schedule 80 steel, butt or socket welded

2.3 PRESSURE REGULATOR

.1 Pressure range: 35 psig to 80 psig
.2 Regulator to be sized and set to match existing in the field for nitrogen system.
.3 End connection: threaded
.4 Body material: WCC steel
.5 Trim: stainless steel
.6 Acceptable product: Fisher Type 627 or approved equal in accordance with B7.

2.4 PRESSURE SAFETY VALVE

.1 Bronze body with stainless steel trim, PTFE seat, plain lift lever.
.2 Set Pressure range: 110 psig
.3 Capacity: 74 SCFM
.4 Connections:

.1 Inlet: ½”

.2 Outlet: ¾”

.5 Acceptable product: Kunkle, Model 363 or approved equal in accordance with B7

2.5 BALL VALVES

.1 NPS 3 inches (80 mm) and smaller shall be full port, two-piece ball valve. The ball valve shall be class 150 WSP and 600 WOG. The body material shall be Brass ASTM B283-C37700 stainless steel trim ASTM A36.. The ends shall be threaded to ANSI B1.20.1.

.2 Acceptable product: M.A Steward and Sons Ltd., Model B-3-SS-LL or approved equal in accordance with B7.

2.6 PRESSURE INDICATOR

.1 Dial size: 2” (50 mm)
.2 Case Material: 304 Stainless Steel
.3 Lens: Acrylic, snap-in type
.4 Connection: 1/4” (6 mm) NPT Standard, Botton connection
.5 Movement: 304 Stainless Steel
.6 Working pressure: Maximum 75% of full-scale value
.7 Temperature range: -40°C to 65°C (-40°F to 150°F)
.8 Accuracy: +/- 2.5% of full-scale value
.9 Enclosure rating: IP52
.10 Range: 0-150 psig
.11 Acceptable product: WINTER, Model PRL024 or approved equal in accordance with B7.

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 PRESSURE REGULATORS

.1 Install regulators on connections to equipment as indicated.

3.3 NITROGENGAS PIPING CONNECTIONS AND INSTALLATION

.1 Install ball valves at vessel outlets, major branch lines and in locations as indicated.
.2 Install pressure gauges on drop pipes.
.3 Install unions to permit removal or replacement of equipment.
.4 Make branch connections from top of main.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11 – Cleaning.
  .1 Leave Work area clean at end of each day.
  .2 Upon completion remove surplus materials, rubbish, tools, and equipment.

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 (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 W-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 Installation of natural gas, digester gas, hydronic hot water and relief blowdown piping systems for new boilers.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B31.3-22, Process Piping

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B149.1:20, Natural Gas and Propane Installation Code.

.2 CAN/CSA B149.3:20, Code for the Field Approval of Fuel-Burning Appliances and Equipment

.3 CAN/CSA B149.6:20, Code for Digester Gas, Landfill Gas, and Biogas Generation and Utilization

.4 Green Seal Environmental Standards (GSES)

.1 Standard GS-11-2008, 2nd Edition, Environmental Standard for Paints and Coatings.

.5 National Fire Code of Canada (NFCC 2005)

.6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113-A2007, Architectural Coatings.

.2 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.3 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, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 MATERIAL

.1 Paint: zinc-rich to CAN/CGSB-1.181.

.1 Primers, paints and coatings: in accordance with manufacturer's recommendations for surface conditions, where required.

Part 3 Execution

3.1 APPLICATION

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

3.2 HOT TAP METHOD

.1 Tie-in points TP-01 and TP-04 to the existing hot water system must be performed by method of hot tap.

.2 The existing hot water boiler system must remain in full operation when these tie-ins are performed. Shutdown of the system, including hot water mix tank and boilers, for any duration is not permitted.

.3 The Contractor shall supply hot tapping services from a qualified hot tapping service vendor to provide design and installation for the hot taps. The Contractor and hot tap vendor must be certified to perform work on pressurized piping systems in the province of Manitoba.

.4 Scope of Work:

.1 A piping stub-in with flanged nozzle and reinforcing pad (“the system”) shall be welded to the existing piping at tie-in locations TP-01 and TP-04, for the purpose of hot tapping. Material, fabrication and installation of the piping stub-in, flanged nozzle, and reinforcing pad shall conform to ASME 31.3-22, and all listed standards therein.

.2 Hot tap service vendor shall design the hot tap system and provide stamped drawings by a professional engineer in Manitoba to the Contract Administrator for review and approval, prior to performing the hot tap.

.3 Non destructive examination shall be performed on the existing piping at tie-in locations TP-01 and TP-04, prior to performing the hot tap, to ensure sufficient wall thickness is remaining. The design of the hot tap system by the vendor, must take the results into consideration. A two-piece tapping sleeve to encapsulate the full circumference of the piping may be required.

.4 Hot tap vendor and Contractor shall submit a hot tap procedure to the Contract Administrator for review and approval, at least three weeks prior to performing the hot tap. The procedure must include contact persons, schedule, risk and contingency plans, step-by-step procedure for performing the hot tap.

.5 The Contractor and hot tap vendor are responsible for providing all equipment, tools, power and materials necessary for performing the hot tap. The Contractor and hot tap vendor must use a hot tap machine that fits within the designated area for performing the hot tap. The Contractor shall field confirm dimensions to ensure the selected machine fits in the space to perform the procedure.

3.3 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.4 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and related codes.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

3.5 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain.

.1 Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Install natural gas and digester gas pipework to CSA B149.1 and CSA B149.6 (respectively).

.2 Install hydronic system hot water pipework and relief blowdown pipework to ASME B31.3.

.3 Protect openings against entry of foreign material.

.4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.5 Assemble piping using fittings manufactured to ANSI standards.

.6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.8 Install concealed pipework to minimize furring space, maximize headroom, and conserve space.

.9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.10 Install, except where indicated, to permit separate thermal insulation of each pipe.

.11 Group piping wherever possible and as indicated.

.12 Ream pipes, remove scale and other foreign material before assembly.

.13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.14 Provide for thermal expansion as indicated.

.15 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

3.8 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:

.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.

.2 Other floors: terminate 25 mm above finished floor.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:

.1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.

.2 Elsewhere:

.1 Provide space for firestopping.

.2 Maintain fire rating integrity.

.3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: one-piece type with set screws.

.1 Chrome or nickel-plated brass or type 302 stainless steel.

.3 Sizes: outside diameter to cover opening or sleeve.

.1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

.1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation.

.2 Uninsulated unheated pipes not subject to movement: no special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fire stopping material or installation.

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

3.11 FLUSHING OUT OF PIPING SYSTEMS

.1 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant mechanical sections.

.2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Contract Administrator 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning Work.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Contract Administrator.

.6 Pay costs for repairs or replacement, retesting, and making good. Contract Administrator to determine whether repair or replacement is appropriate.

.7 Insulate or conceal Work only after approval and certification of tests by Contract Administrator.

3.13 EXISTING SYSTEMS

.1 Connect into existing piping systems as indicated.

.2 Be responsible for damage to existing equipment by this Work.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Section Includes:

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.3 Closeout Submittals

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: Work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial regulations.

1.5 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 GENERAL

.1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors under 373 W (1/2 HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 208 V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning Work, install motor approved by Contract Administrator for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 Correct size of sheave determined during commissioning.

.5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.6 Motor slide rail adjustment plates to allow for centre line adjustment.

.7 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm dia. holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.-

.5 Guard for flexible coupling:

- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

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 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

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

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

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

3.4 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 Section includes:

.1 Welding of hydronic hot water piping and relief blowdown piping for new boilers.
.2 Welding of natural gas and digester gas piping.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.3-22, Process Piping.
.2 ANSI/ASME Boiler and Pressure Vessel Code-07:
.1 BPVC 2007 Section I: Power Boilers.
.2 BPVC 2007 Section V: Non-destructive Examination.
.3 BPVC 2007 Section IX: Welding and Brazing Qualifications.

.2 American Welding Society (AWS)

.1 AWS C1.1M/C1.1-[2000(R2006)], Recommended Practices for Resistance Welding.
.2 AWS Z49.1-[2005], Safety in Welding, Cutting and Allied Process.
.3 AWS W1-[2000], Welding Inspection Handbook..

.3 CSA Group (CSA)

.1 CSA W48-[06], Filler Metals and Allied Materials for Metal Arc Welding.
.2 CSA B51-[03(R2007)], Boiler, Pressure Vessel and Pressure Piping Code.
.3 CSA-W117.2-[2006], Safety in Welding, Cutting and Allied Processes.
.4 CSA W178.1-[2008], Certification of Welding Inspection Organizations.
.5 CSA W178.2-[2008], Certification of Welding Inspectors. SPEC NOTE: Insert applicable provincial or territorial codes and regulations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders:
.1 Welding qualifications in accordance with CSA B51.
.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
.3 Submit welder's qualifications to Contract Administrator.
.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors:

.1 Inspectors qualified to CSA W178.2.

.3 Certifications:

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

Part 2 PRODUCTS

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series

Part 3 EXECUTION

3.1 APPLICATION

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

3.2 QUALITY OF WORK

.1 Welding: in accordance with ANSI/ASME B31.3, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

3.3 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Fittings:

.1 NPS 2 and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Contract Administrator before Work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Contract Administrator.

.3 Do not conceal welds until they have been inspected, tested, and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

.5 Contractor shall retain and pay for the services of the welding inspector.

3.5 SPECIALIST EXAMINATIONS AND TESTS

.1 General:

.1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Contract Administrator.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 Inspect and test 5 % of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and radiographic tests.

.2 Hydrostatically test welds to ANSI/ASME B31.3.

.3 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.4 Failure of visual examinations:

.1 Upon failure of welds by visual examination, perform additional testing as directed by Contract Administrator of total of up to 10 % of welds, selected at random by Contract Administrator.

.5 Full radiographic tests for hot water piping systems.

.1 Radiographic film:

.1 Identify each radiographic film with date, location, name of welder, and submit to Contract Administrator. Replace film if rejected because of poor quality.

.2 Interpretation of radiographic films:

.1 By qualified radiographer.

.3 Failure of radiographic tests:

.1 Extend tests to welds by welder responsible when those welds fail tests.

.6 Magnetic particle tests for hot water piping systems.

3.6 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.3 and ANSI/ASME Boiler and Pressure Vessels Code

3.7 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Section includes:

.1 Materials and installation for pressure gauges for piping systems.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B40.100-2005, Pressure Gauges and Gauge Attachments.

.2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid-point of scale or range.

.2 Range: 0-1100 kPa for hot water piping.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, liquid filled, 125 mm scale length: to CAN/CGSB-14.4.

.1 Resistance to shock and vibration.

2.3 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

2.4 PRESSURE GAUGES

.1 Dial type: to ASME B40.100, Grade 2A, liquid filled, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified. Sizes: 75mm, 100mm, 150mm.

.2 Provide:

.1 Snubber for pulsating operation.
.2 Diaphragm assembly for corrosive service.
.3 Gasketted pressure relief back with solid front.
.4 Bronze stop cock.

Part 3 Execution

3.1 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform.
.1 If this cannot be accomplished, install remote reading units.
.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Install in wells on piping. Include heat conductive material inside well.
.2 Install in locations as indicated and on inlet and outlet of:
.1 Heat exchangers.
.2 Water boilers.
.3 DHW tanks.
.4 Heat Pumps
.3 Install wells for balancing purposes.
.4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in locations as follows:
.1 Suction and discharge of pumps.
.2 Upstream and downstream of PRV's.
.3 Upstream and downstream of pressure control valves and pressure regulators.
.4 Inlet and outlet of liquid side of heat exchangers.
.5 Outlet of boilers.
.6 In other locations as indicated.
.2 Install gauge cocks for balancing purposes, elsewhere as indicated.
.3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

.1 Install engraved lamicoid nameplates in accordance with Section 23 05 53.01 - Mechanical Identification, identifying medium.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Section includes:

.1 Materials and installation for gas and hydronic 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 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 164 kg/m^3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.6 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.

2.7 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.

2.8 EQUIPMENT SUPPORTS

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

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.10 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 at pumps, boilers, chillers, cooling towers, and as indicated.

.3 Clamps on riser piping:

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

.2 Bolt-tightening torques to industry standards.

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

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with 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 Natural gas piping: to CSA B149.1 and authority having jurisdiction.

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

.4 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

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

.6 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 J and K.

.2 Tag naming standard located in Appendix M.

.3 Paint colour standard located in Appendix O.

1.2 RELATED SECTIONS:

.1 01 33 00 - Submittal Procedures

.2 01 74 11 - Cleaning.

1.3 REFERENCES

.1 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.

.2 CSA B149.6, Code for Digester Gas, Landfill Gas, and Biogas Generation and Utilization

.2 Canadian General Standards Board (CGSB)

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

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

.3 National Fire Protection Association (NFPA)

.1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.

.2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose 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: back, 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 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other Work as specified in this section.

1.2 SCOPE OF WORK

.1 TAB of new hot water circulating pumps and existing pumps associated with existing boiler 7.

.2 Coordinate Work with all applicable sections including section 23 09 33 Electric and Electronic Control for HVAC

1.3 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Contract Administrator within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.9 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist. Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.4 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.5 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.6 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.7 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Contract Administrator in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.8 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.9 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

1.10 START OF TAB

.1 Notify Contract Administrator 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.
.2 Duct systems clean.
.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
.4 Correct fan rotation.
.5 Fire, smoke, volume control dampers installed and open.
.6 Coil fins combed, clean.
.7 Access doors, installed, closed.
.8 Outlets installed; volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.
.2 Correct pump rotation.
.3 Strainers in place, baskets clean.
.4 Isolating and balancing valves installed, open.
.5 Calibrated balancing valves installed, at factory settings.
.6 Chemical treatment systems complete, operational.

1.11 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus or minus 5%.

.2 Hydronic systems: plus or minus 10 %.

1.12 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2% of actual values.

1.13 INSTRUMENTS

.1 Prior to TAB, submit to Contract Administrator list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Contract Administrator.

1.14 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Contract Administrator, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.16 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.
.2 System schematics.

.3 Submit one copies of TAB Report to Contract Administrator for verification and approval, in English in electronic (PDF) format.

1.17 VERIFICATION

.1 Reported results subject to verification by Contract Administrator.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results as directed by Contract Administrator.

.4 Pay costs to repeat TAB as required to satisfaction of Contract Administrator.

1.18 SETTINGS

.1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.19 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Contract Administrator.

1.20 AIR SYSTEMS

.1 Standard: TAB to most stringent of TAB standards of AABC.

.2 Do TAB of systems, equipment, components, controls specified Division 23.

.3 Qualifications: personnel performing TAB current member in good standing of AABC.

.4 Quality assurance: perform TAB under direction of supervisor qualified by AABC.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.21 OTHER TAB REQUIREMENTS

.1 General requirements applicable to Work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

.2 Smoke management systems:

.1 Test for proper operation of all smoke and fire dampers, sensors, detectors installed as component parts of air systems specified Division 23.

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 Section Includes:

.1 Insulation of new hot water piping, including any modified areas of existing piping.

.2 Insulation of flash tank vent piping 2m below the underside of the roof and continuation of the insulation through roof penetration up to vent termination.

.3 Jackets shall be painted per City of Winnipeg Water and Waste Paint Colour Standard located in Appendix O.

1.2 RELATED SECTIONS

.1 01 33 00 - Submittal Procedures

.2 01 74 11 - Cleaning.

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.

.2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C547-2003, Mineral Fiber Pipe Insulation.

.7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

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

.1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings

.4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.4 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.5 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.3 Shop Drawings:

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

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

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

.2 Instructions: submit manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.2 Installer: specialist in performing Work of this Section, and have at least 3 years successful experience in this size and type of project.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702.

.2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

.5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

.6 TIAC Code A-6: flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

.4 Certified by manufacturer: free of potential stress corrosion cracking corrodents.

.7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.

.1 Insulation: to ASTM C533.

.2 Maximum "k" factor: to CAN/ULC-S702.

.3 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

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

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated 305 g/m^2.

2.8 JACKETS

.1 **Indoor**: Canvas jacket to match existing piping:

.1 Colours: per City of Winnipeg Water and Waste *Paint Colour Standard* located in Appendix O.

.2 **Outdoors:** water proof aluminum jacket.

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 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: at expansion joints, valves, flanges and unions at equipment.

.2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: canvas.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Hot Water Piping	60 - 121	A-1	25	38	38	38	38	38
Flash tank vent	60 - 121	A-1	25	38	38	38	38	38

.3 Finishes:

.1 Exposed indoors: canvas jacket.

.2 Exposed in mechanical rooms: canvas jacket.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoors: water-proof aluminum jacket.

.6 Finish attachments: SS bands, at 150 mm on centre.

.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 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 Section includes:

.1 Performance verification of new boilers and associated circulating pumps, gas supplies, and new drainage piping.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

1.3 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

.1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 72 hours to demonstrate compliance with design criteria.

.2 Verify performance of hydronic system circulating pumps as specified, recording system pressures and temperatures.

1.4 HYDRONIC SYSTEM CAPACITY TEST

.1 Perform hydronic system capacity tests after:

.1 TAB has been completed

.2 Verification of operating, limit, safety controls.

.3 Verification of primary and secondary pump flow rates.

.4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

.5 Heating system capacity test:

.1 Perform capacity test when ambient temperature is within 10% of design conditions.

.2 Test procedures:

.1 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.

.2 Conduct flue gas analysis test on boilers at full load and at low fire conditions.

1.5 GASEOUS FUEL SYSTEMS

.1 Operation tests:

.1 Measure gas pressure at gas metre outlet and at burner manifold.

.2 Verify details of temperature and pressure compensation at meter.

.3 Verify settings, operation, venting of high and low pressure cut-outs, alarms.

.4 Check terminals of vents for gas pressure regulators.

1.6 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Buried systems: perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.

.2 Ensure that traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system.

.4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.

1.7 REPORTS

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

1.8 TRAINING

.1 In accordance with Section 01 91 13 - General Commissioning Requirements: Training of O&M Personnel, supplemented as specified herein.

.1 Include following:

.1 Boilers and hot water circulating pumps.

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 Section Includes:

.1 Procedures for cleaning mechanical piping systems.

1.2 REFERENCE STANDARDS

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

.2 Safety Data Sheets (SDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.2 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

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

.4 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.2 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.3 Waste Management and Disposal:

.4 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance local standards.

Part 2 Products

.1 Not used.

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 CLEANING HYDRONIC SYSTEMS

.1 Perform mechanical cleaning to remove welding slag

.2 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.

.3 Cleaning Agency:

.4 Retain qualified water treatment specialist to perform system cleaning.

.5 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete [by water treatment specialist].

.6 Cleaning procedures:

.7 Provide detailed report outlining proposed cleaning procedures prior to hot water piping installation. Report to include:

- .1 Cleaning procedures to remove welding slag, construction debris, dirt, and any other foreign materials from hot water pipe spools prior to installation.
- .2 Inspection procedures to verify cleanliness of complete interior of piping prior to installation.
- .3 Special precautions for protecting piping system materials and components. Temporary startup strainers shall be provided on inlet piping to boilers.

.8 Cleaning and inspection of piping shall be performed to the satisfaction of the Contract Administrator.

3.3 START-UP OF HYDRONIC SYSTEMS

.1 Provide plan for system filling using make-up from existing boiler hot water system for review. Following approval from Contract Administrator:

.2 Fill new piping from existing boiler hot water system.

.3 Establish circulation.

.4 Ensure air is removed.

.5 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.

.6 Clean out startup strainers repeatedly until clean.

.7 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.8 Adjust pipe supports, hangers, springs as necessary.

.9 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

.10 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.11 Check operation of drain valves.

.12 Adjust valve stem packings as systems settle down.

.13 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.4 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 Section Includes:

.1 Materials and installation for natural gas and digester gas piping, valves and fittings for gas fired equipment.

.2 Refer to Separate Price 1 and Separate Price 2 related to digester gas piping.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5-03, Pipe Flanges and Flanged Fittings.

.2 ASME B16.11-21 – Forged Fittings, Socket-Welding and Threaded

.3 ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.

.4 ASME B16.22-01, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.5 ASME B18.2.1-96, Square and Hex Bolts and Screws Inch Series.

.6 ASME B36.19M-18, Stainless Steel Pipe

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A47/A47M-99(2004), Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M-04, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 ASTM B75M-99, Standard Specification for Seamless Copper Tube Metric.

.4 ASTM B837-01, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

.3 Canadian Standards Association (CSA International)

.1 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.

.4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)

.1 CAN/CSA B149.1:20, Natural Gas and Propane Installation Code.

.2 CSA 149.3-20, Code for the filed approval of fuel-burning appliances and equipment

.3 CSA 149.6-20, Code for digester gas, landfill gas, and biogas generation and utilization

.5 American National Standards Institute (ANSI)/ Canadian Standards Association (CSA)

.1 ANSI Z21.21-2015/CSA 6.5-2015, Automatic valves for gas appliances

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

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.6 All digester gas components, equipment and other products shall be rated for the pressure, temperature and composition of NEWPCC digester gas. Product vendors must provide written declaration and certify their product is compatible with NEWPCC digester gas.

Part 2 Products

2.1 NATURAL GAS

.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

.1 NPS 1/2 to 2, screwed.

.2 NPS 2 1/2 and over, plain end.

.2 JOINTING MATERIAL

.1 Screwed fittings: joint sealant to CAN/ULC-S642.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.3 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ASME B16.5.

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ASME B18.2.1.

.6 Nipples: schedule 40, to ASTM A53/A53M.

.4 VALVES

.1 Provincial Code approved, ball or lubricated plug type. To comply with CSA B149 and standards listed therein.

.5 AUTOMATIC SAFETY SHUTOFF VALVES

.1 Automatic safety shutoff valves for each boiler (Boiler 1 and Boiler 2)

.1 Service: Natural gas

.2 Body material: Die-cast aluminium

.3 Size: DN 50 (NPS 2")

.4 End connection: ANSI (NPT) threaded

.5 Voltage: 120 V 60 Hz

.6 Enclosure Rating: Nema 4

.7 Position: Normally closed shut-off

.8 Includes proof of closure switch

.9 Certified to CGA 3.9 or ANSI Z21.21/CSA 6.5 and marked C/I in accordance with CSA B149.3.

.10 Acceptable Product: Honeywell V5055C1000/U valve with V4055D1027/U actuator or approved equal in accordance with B7.

.6 AUTOMATIC VENT VALVES

.1 Automatic vent valves for each boiler (Boiler 1 and Boiler 2)

.1 Service: Natural gas

.2 Body material: Carbon steel

.3 Body seal and bumper material: Buna

.4 Size: DN 25 (NPS 1")

.5 End connection: ANSI (NPT) threaded

.6 Voltage: 115 V 60 Hz

.7 Enclosure Rating: Nema 4

.8 Position: Normally open

.9 Certified to ANSI Z21.21/CSA 6.5 in accordance with CSA B149.3.

.10 Acceptable Product: MAXON 100SMA21-AA22-BB12A0 or approved equal in accordance with B7.

2.2 DIGESTER GAS

.1 PIPE

.1 Stainless Steel piping, 316 SS:

.1 DN 50 (2" NPS) and under: Schedule 40S, seamless, threaded ends, complies with ASME B36.19M.

.2 DN 65 (2 1/2" NPS) and over: Schedule 40S, seamless, welded fittings and flanged ends, complies with ASME B36.19M.

.3 Type 316L SS shall be used when field welding is required.

.2 JOINTING MATERIAL

.1 Flanges: ANSI Class 150, 316 stainless steel, slip-on, raised face to ASME B16.5.

.2 Flange bolts: finished hexagon type with suitable nuts, 304 stainless steel to ASME B18.2.1.

.3 Steel pipe flanges and flanged fittings: to ASME B16.5.

.4 Gasket: full face, 3.17 mm thick, neoprene, with hardness no less than 40 measured on Shore durometer "A" scale.

.3 TUBING

.1 Stainless steel, to comply with CSA B149.6

.4 FITTINGS

.1 Pipe Fittings:

.1 DN 50 (2” NPS) and under:

.1 Threaded end type, Class 300 to ASME B16.11.

.2 DN 65 (2 1/2” NPS) and over:

.1 Butt-welded, schedule to match adjoining pipe, to ASME B16.9 and MSS SP-43.

.2 Tube Fittings

.1 To comply with CSA B149.6.

.5 VALVES

.1 Provincial Code approved, ball or lubricated plug type. To comply with CSA B149 and standards listed therein.

.2 All valves to comply with CSA B149.3 and certified with applicable standards therein. Valve must be marked in accordance with CSA B149.3 and CSA B149.6.

.3 Ball Valves:

.1 Ball valves 2” (50 mm) and under:

.1 Stainless steel body, blow-out proof stem, lever operated, NPT connections.

.2 Minimum Temperature: -40°C (-40°F)

.3 Valve seat rating: 2000 WOG

.4 CSA 3.16 approved

.2 Acceptable Product: NEO VALVES, Model NE-2500 or approved equal in accordance with B7.

.4 Check Valve:

.1 Type: Swing

.2 Size: 1" (25 mm)

.3 Body Material: 316 Stainless Steel

.4 End connection: threaded

.5 Acceptable Product: NEWCO or approved equal in accordance with B7.

.6 AUTOMATIC SAFETY SHUTOFF VALVES

.1 Automatic safety shutoff valves for each boiler (Boiler 1 and Boiler 2)

.1 Service: Digester gas

.2 Body material: Stainless steel

.3 Body seal and bumper material: viton

.4 Size: DN 80 (NPS 3”)

.5 End connection: ANSI Flanged

.6 Voltage: 115 V 60 Hz

.7 Enclosure Rating: Nema 4X

.8 Position: Normally closed shut-off

.9 Includes proof of closure switch

.10 Certified to CGA 3.9 or ANSI Z21.21/CSA 6.5 and marked C/I in accordance with CSA B149.3.

.11 Acceptable Product: MAXON 300CMA11-BC52-BB221B0 or approved equal in accordance with B7.

.7 AUTOMATIC VENT VALVES

.1 Automatic vent valves for each boiler (Boiler 1 and Boiler 2)

.1 Service: Digester gas

.2 Body material: Stainless steel

.3 Body seal and bumper material: viton

.4 Size: DN 40 (NPS 1 1/2")

.5 End connection: ANSI (NPT) threaded

.6 Voltage: 115 V 60 Hz

.7 Enclosure Rating: Nema 4X

.8 Position: Normally open

.9 Certified to ANSI Z21.21/CSA 6.5 in accordance with CSA B149.3.

.10 Acceptable Product: MAXON 150SMA21-AC52-BB21B0 or approved equal in accordance with B7.

.8 ORIFICE PLATE FLOW METER

.1 Orifice Plate Flowmeter for each boiler (Boiler 1 and Boiler 2):

.1 Fluid Type: Gas

.2 Orifice Plate Type: Paddle, Concentric

.3 Tap Type: Flange Tapping

.4 Process Connection: ASME B16.36 CL 150 RF

.5 Line Size: 4" (DN100)

.6 Bore Size: 2.569"

.7 Flange Rating: Flange ANSI Class 150 Raised Face c/w tappings

.8 Material Type: 316/316L Stainless Steel

.9 Thickness: 0.125"

.10 Normal Operating Conditions

.1 Pressure: 2.7 psig

.2 Temperature: 25 °C

.3 Flow Rates:

.1 Normal: 11700 SCF/hr

.2 Maximum: 12560 SCF/hr

.11 Acceptable Product: Rosemount, 1495 Orifice Plate.

.9 PRESSURE REDUCING REGULATORS

.1 Pressure reducing regulator for each boiler (Boiler 1 and Boiler 2):

.1 Body material: Stainless steel

.1 Alternate material may be provided with a declaration from the manufacturer stating the component is suitable for use with NEWPCC digester gas.

.2 Sized for boiler digester gas output of 3,222 kW

.3 Operating pressures: 117 kPa (17 psig) inlet, 18.6 kPa (2.7 psig) outlet

.4 Maximum pressure upstream: 209 kPa (30 psig)

.5 Maximum digester gas flowrate: 648 Nm^3/h

.6 Operating digester gas flow range: 331 – 355 Nm^3/h

.7 Size: DN 50 (2” NPS)

.8 Connections: Class 150 flanged.

.9 Lock-up positive shutoff type.

.10 PRESSURE RELIEF VALVE

.1 Pressure relief valve for each boiler (Boiler 1 and Boiler 2):

.1 Body material: Stainless steel

.1 Alternate material may be provided with a declaration from the manufacturer stating the component is suitable for use with NEWPCC digester gas.

.2 Range: 12 kPa (1.75 psig) to 48 kPa (7 psig)

.3 Maximum digester gas flowrate: 648 Nm^3/h

.4 Operating digester gas flow range: 331 – 355 Nm^3/h.

.5 Size: DN 50 (2” NPS).

.11 STRAINER

.1 Strainer for each boiler (Boiler 1 and Boiler 2)

.1 Body material: Stainless steel

.2 Size: 4” (100 mm)

.3 Screen material: 304 Stainless steel

.4 Screen size: 0.125” (3.2 mm)

.5 Gasket: Stainless steel spiral wound

.6 End Connections: RF flanged, ASME B16.5.

.7 Drain/Blow-off Connection: Furnished with plug

.8 Maximum allowable working pressure: 275 psig

.9 Minimum Temperature: -28.9°C (-20°F)

.10 Complete with gauge taps on inlet and outlet.

.11 Acceptable Product: Stayflow, Model YSF1 or approved equal in accordance with B7.

.12 DIFFERENTIAL PRESSURE INDICATOR

.1 Differential pressure indicator for each boiler (Boiler 1 and Boiler 2)

.1 Type: Piston

.2 Dial size: 4.5” (115 mm)

.3 Connections: ¼” (6 mm) NPTF

.4 Body Material: Stainless Steel

.5 Wetted parts material: stainless steel with ceramic magnet

.6 Standard Differential Range: 0-5 thru 110 psig

.7 Maximum system pressure: 6,000 psi

.8 Temperature range: -40°C to 93°C (-40°F to 200°F)

.9 Accuracy: +/- 2% full scale ascending

.10 Acceptable Product: WINTERS, Model PPD or approved equal in accordance with B7.

.13 PRESSURE INDICATOR

.1 Low pressure Indicator for each boiler (Boiler 1 and Boiler 2):

.1 Socket/Movement: 316 stainless steel

.2 Case: 304 stainless steel

.3 Wetted parts material: stainless steel

.4 Dial size: 2.5” (63 mm)

.5 Connections: ¼” (6 mm) NPT

.6 Lens: Polycarbonate

.7 Enclosure Rating: IP52

.8 Temperature range: -40°C to 65°C (-40°F to 150°F)

.9 Working pressure: 75% of full scale value

.10 Accuracy: +/- 1.6% of full scale

.11 Range: 0-10 psig

.12 Acceptable Product: WINTERS, Model PLP or approved equal in accordance with B7.

.2 High pressure Indicator for each boiler (Boiler 1 and Boiler 2):

.1 Socket/Movement: 316 stainless steel

.2 Case: 304 stainless steel

.3 Wetted parts material: stainless steel

.4 Dial size: 2.5” (63 mm)

.5 Connections: ¼” (6 mm) NPT

.6 Lens: Polycarbonate

.7 Enclosure Rating: NEMA 4X

.8 Temperature range: -40°C to 120°C (-40°F to 250°F)

.9 Working pressure: 75% of full scale value

.10 Accuracy: +/- 1.6% of full scale

.11 Range: 0-40 psig

.12 Acceptable Product: WINTERS, Model PFP or approved equal in accordance with B7.

.14 SIGHT GLASS

.1 Sight glass

.1 Material: stainless steel

.2 End connection: threaded NPT, complete with stainless steel shutoff valve

.3 Temperature range: 2°C to 205°C (35°F to 400°F)

.4 Maximum pressure: 250 psig

.5 Visible length: 350 mm (14”)

.6 Window material: glass

.7 Complete with guard rods

.8 Acceptable Product: McMASTER-CARR, Model 30703K3 or approved equal in accordance with B7.

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 PIPING

.1 Fabricate, install, examine and test in accordance with Section 23 05 05 - Installation of Pipework, CAN/CSA B149, and applicable Provincial Codes, supplemented as specified.

.2 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

.3 Prime and paint gas piping safety yellow, according to applicable codes.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.

.2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 PRESSURE REDUCING REGULATORS

.1 Install pressure reducing regulator for each boiler.

3.5 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Test system in accordance with CAN/CSA B149 and requirements of authorities having jurisdiction.

.2 Submit results of testing and reports by the authority having jurisdiction to the Contract Administrator.

.2 Manufacturer's Field Services:

.1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.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 at stages listed:

.1 Upon completion of Work, after cleaning is carried out.

.3 Obtain reports within 3 days of review and submit immediately to Departmental Representative.

.4 PV procedures:

.1 Test performance of components.

3.6 ADJUSTING

.1 Purging: purge after pressure test in accordance with CAN/CSA B149.

.2 Pre-Start-Up Inspections:

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.7 CLEANING

.1 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 Section includes:

.1 Materials and installation for steel piping, valves and fittings for new boilers hot water and relief blowdown systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 23 05 17 - Pipe Welding.

.4 Section 23 08 16 - Cleaning and Start-up of Mechanical Piping Systems.

.5 Section 23 05 05 - Installation of Pipework.

.6 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.7 Section 23 08 13 - Performance Verification of Mechanical Piping.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.1 ASME B16.1-98, Cast Iron Pipe Flanges and Flanged Fittings.
.2 ASME B16.3-98, Malleable Iron Threaded Fittings.
.3 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
.4 ASME B16.9-01, Factory-Made Wrought Buttwelding Fittings.
.5 ASME B16.34-20, Valves – Flanged, Threaded, and Welding End
.6 ASME B18.2.1-03, Square and Hex Bolts and Screws (Inch Series).
.7 ASME B18.2.2-87(R1999), Square and Hex Nuts (Inch Series).
.8 ASME B31.3-22, Process Piping

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A47/A47M-99, Standard Specification for Ferritic Malleable Iron Castings.
.2 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
.3 ASTM A536-84(1999)e1, Standard Specification for Ductile Iron Castings.
.4 ASTM B61-02, Standard Specification for Steam or Valve Bronze Castings.
.5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
.6 ASTM E202-00, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.3 American Water Works Association (AWWA).

.1 AWWA C111-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).

.1 CSA B242-M1980(R1998), Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CAN/CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67-025, Butterfly Valves.

.2 MSS-SP-70-98, Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71-97, Cast Iron Swing Check Valves Flanged and Threaded Ends.

.4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

.5 MSS-SP-85-02, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.4 SUBMITTALS

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

.2 Closeout Submittals.

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

1.5 MAINTENANCE

.1 Extra Materials.

.1 Provide following spare parts:

.1 Valve seats: one for every ten valves, each size. Minimum one.

.2 Discs: one for every ten valves, each size. Minimum one.

.3 Stem packing: one for every ten valves, each size. Minimum one.

.4 Valve handles: two of each size.

.5 Gaskets for flanges: one for every ten flanges.

Part 2 Products

2.1 DESIGN CONDITIONS

.1 All materials used in hydronic systems piping shall be rated for minimum 1100 kPa (160 psi) at 121 °C (250 °F).

2.2 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:

.1 NPS ½ to 2: Schedule 80.

.2 To NPS 10: Schedule 40.

2.3 PIPE JOINTS

.1 NPS 2 and under: screwed fittings with Teflon tape.

.2 NPS 2 1/2 and over: welding fittings and flanges to CSAW47.1 and CSA W47.1S1.

.3 Flanges: raised face, weld neck, forged steel ASTM A105N, ANSI B16.5 Class 150.

.4 Flange gaskets: Full face gasket, 3.2 mm thick, Class 150, NBR, max temperature: 371 C, max pressure: 1000 psi

.1 Acceptable product: Garlock BLUE-GARD Style 3000 or approved equivalent in accordance with B7.

.5 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.

.6 Pipe thread: taper.

2.4 FITTINGS

.1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:

.1 Steel: to ANSI/ASME B16.5.

.3 Unions: malleable iron, to ASTM A47M and ANSI/ASME B16.3.

.4 Butt - welding fittings: steel, to ANSI/ASME B16.9.

2.5 VALVES

.1 Connections:

.1 NPS 2 and smaller: NPT ends.

.2 NPS 2 ½ and larger: flanged ends.

.2 Ball Valves:

.1 NPS 2 and under:

.1 600 WOG, bronze body, NPT, TFE seal, hard chrome solid ball, Teflon seats and lever handle.

.2 Acceptable material: MAS B3, Red-White 5044A, or approved equivalent in accordance with B7.

.2 NPS 2 ½ and over:

.1 Class 150, floating-ball design, full port, ductile iron body to ASTM A536, 300# WOG, PFA infused stainless steel ball, stainless steel blowout proof stem, PTFE body seat and body seals, PTFE stem seal, locking valve handle, flanged ends

.2 Acceptable material: American Valve 4000D Series or approved equivalent in accordance with B7.

.3 Ball Valves, 3-Way:

.1 NPS 2 and under:

.1 400 WOG, reduced L-port, bronze body, NPT, TFE seal, hard chrome solid ball, Teflon seats and lever handle.

.2 Acceptable material: MAS B-3L, Red-White 5045A, or approved equivalent in accordance with B7.

.4 Gate valves:

.1 NPS 2 and under:

.1 Non-rising stem, to MSS SP-80, Class 150, bronze body, NPT, solid wedge disc.

.2 Acceptable material: Red-White 204A, Kitz 46 (AK150E), or approved equivalent in accordance with B7.

.2 NPS 2 ½ and over:

.1 Class 150, API 600, OS & Y, bolted bonnet, A216 WCB cast steel body/bonnet, 13Cr wedge/disc surface, Stellite 6 seat surface, A182 stem, 316L/graphite gasket, flexible graphite packing, B7/2H bolting B16.5 flanged ends, ductile iron handwheel.

.2 Provide chainwheel operator for valves higher than 2.0 m above floor.

.3 Acceptable material: Kitz 150SCLS or approved equivalent in accordance with B7.

.5 Check Valves:

.1 NPS 2 and under:

.1 Class 150, NPT, MSS SP-80, Y-pattern swing type, bronze body and disc, integral seat

.2 Acceptable material: Kitz 29 (AK150YR) or approved equivalent in accordance with B7.

.3 NPS 2 ½ and over:

.1 Class 150, globe-style, spring-assist silent closing, A216 WCB steel body, stainless steel A351 CF8M trim, stainless steel spring.

.4 Acceptable material: Mueller Steam Specialty Model 105MDT or approved equivalent in accordance with B7.

2.6 STRAINER

.1 Class 125, ANSI B16.1

.2 Size: 6” (150 mm)

.3 Lead-free cast-iron body, 304 stainless steel perforated screens, and a drain/blowoff connection furnished with a closure plug.

.4 Maximum operating pressure: 200 psi, non-shock at 99°C (210°F)

.5 Certified by NSF.

.6 Acceptable material: WATTS, Model 77F-DI-125 or approved equivalent in accordance with B7.

2.7 AUTOMAITC AIR VENT VALVES

.1 Air Release Valves shall be automatic float operated valves designed to release accumulated air from a piping system while the system is in operation and under pressure.

.2 The valve body and cover shall be constructed of ASTM A126 Class B cast iron for working pressures up to 300 psig. The orifice, float and linkage mechanism shall be constructed of Type 316 stainless steel

.3 Air release valve to be sized for hydronic system operating flow and temperature.

.4 Valve discharge shall be routed to a safe location.

.5 Acceptable material: Val-Matic Valve or approved equivalent in accordance with B7.

2.8 RELIEF VALVE SEPARATOR TANK

.1 Constructed of 10mm (3/8”) plate, ASME Code designed and stamped for 150 PSI at 450ºF (232ºC) with a 150mm (6”) 150# flanged tangential inlet, 150mm (6”) 150# flanged drain and a 200mm (8”) 150# flanged vent.

.2 Acceptable product: “Penn” Model 18” diameter by 34” high SRV Separator with a set of three (3) legs model A100L or approved equivalent in accordance with B7.

Part 3 Execution

3.1 PIPING

.1 Fabricate, install, examine and test in accordance with Section 23 05 05 - Installation of Pipe Work, ASME B31.3, and applicable Provincial Codes, supplemented as specified.

.2 Piping Contractor shall be qualified to perform pressure piping fabrication and installation under Provincial regulations.

3.2 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and when TAB is complete.

3.3 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section 23 08 16 - Cleaning and Start-Up of Mechanical Piping Systems.

3.4 TESTING

.1 Perform hydrostatic testing of hot water piping in accordance with ASME B31.3.

3.5 BALANCING

.1 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

3.6 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 13 - Performance Verification of Mechanical Piping.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Supply, installation and commissioning of boiler pumps P-B0110, P-B012 and P-B0130 as specified herein.

1.2 REFERENCES

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 Electrical Equipment Manufacturers Advisory Council (EEMAC)

.3 Canadian Standards Association (CSA International)

.1 CSA-B214-07, Installation Code for Hydronic Heating Systems.

.4 National Electrical Manufacturers' Association (NEMA)

.1 NEMA MG 1-2006, Motors and Generators.

1.3 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 datasheets for pump, circulator, and equipment, and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.

.3 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 BOILER PUMPS (P-B0110, P-B012 and P-B0130)

.1 Single stage, end suction type, horizontal base mounted on a rigid, single piece baseplate, with grouting hole. Ductile iron ASTM A536 and E-coated casting.

.2 Pump shaft: 316 Stainless steel, supported by two heavy duty ball bearings.

.3 Gasket: Synthetic Fiber.

.4 Secondary seal: EPDM

.5 Rated Operating Point: 29 L/s (460 usgpm) against total differential head of 15.2 m (50 ft.), 6.9 BHP.

.6 Rated Operating Point Efficiency: 84% or higher

.7 Pump speed at Rated Operating Point: 1490 rpm (VFD controlled)

.8 Impeller: Body: bronze, diameter: 226 mm (8.9”), fully enclosed and dynamically balanced to ANSI G6.3 and fitted to shaft with key.

.9 Maximum temperature: 250 °F (121 °C)

.10 Maximum pressure: 300 psi (2068 kPa)

.11 Connections:

.1 Inlet: 127 mm (5”)

.2 Outlet: 102 mm (4”)

.12 Motor: 11.2 kW (15 HP), 575/3/60, 1800 RPM, Inverter Duty, NEMA Premium 12.12 Efficiency rating, TEFC enclosure, motor shall be non-overloading at any point on the impeller curve.

.13 Acceptable product: Armstrong 4030 or approved equivalent in accordance with B7.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install hydronic pumps to: CSA-B214.

.2 In line circulators: install as indicated by flow arrows.

.1 Support at inlet and outlet flanges.

.2 Install with bearing lubrication points accessible.

.3 Base mounted type: supply templates for anchor bolt placement.

.1 Include anchor bolts with sleeves. Place level, shim unit and grout.

.2 Align coupling in accordance with manufacturer's recommended tolerance.

.4 Ensure that pump body does not support piping or equipment.

.1 Provide stanchions or hangers for this purpose.

.2 Refer to manufacturer's installation instructions for details.

.5 Install volute venting pet cock in accessible location.

.6 Check rotation prior to start-up.

.7 Install pressure gauge test cocks.

3.3 START-UP

.1 General:

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

.2 In accordance with manufacturer's recommendations.

.2 Procedures:

.1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.

.2 After starting pump, check for proper, safe operation.

.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.4 Check base for free-floating, no obstructions under base.

.5 Run-in pumps for 12 continuous hours minimum.

.6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.7 Eliminate air from scroll casing.

.8 Adjust water flow rate through water-cooled bearings.

.9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.

.10 Adjust alignment of piping and conduit to ensure true flexibility.

.11 Eliminate cavitation, flashing and air entrainment.

.12 Adjust pump shaft seals, stuffing boxes, glands.

.13 Measure pressure drop across strainer when clean and with flow rates as finally set.

.14 Replace seals if pump used to degrease system or if pump used for temporary heat.

.15 Verify lubricating oil levels.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Section Includes:

.1 Heating boiler units:

.1 Supply, Delivery, Hoisting/Craning/Placement, Installation, and Commissioning of the boilers and accessories as specified herein.

.2 Provide on-site boiler start-up and commissioning, including ITS Manitoba (AHJ) approvals by contractor and manufacturer (or manufacturer's representative).

.2 Special Requirements:

.1 Refer to mechanical drawings for boiler orientation and layout. Placement of the control panels and gas trains shall be mirrored as shown on the drawings.

.3 Related Sections:

.1 01 33 00 - Submittal Procedures
.2 01 78 00 - Closeout Submittals
.3 01 74 11 - Cleaning.
.4 01 79 00 – Demonstration and Training
.5 01 91 13 - General Commissioning Requirements
.6 Appendix B - Commissioning Plan
.7 Appendix C - Construction Plan

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 REFERENCES

.1 American Boiler Manufacturer's Association (ABMA)

.2 American National Standards Institute (ANSI)

.1 ANSI Z21.13-2004/CSA 4.9-2004, Gas-Fired Low-Pressure Steam and Hot Water Boilers.

.3 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV, 2004.

.4 Canadian Gas Association (CGA)

.1 CAN1-3.1-77(R2001), Industrial and Commercial Gas-Fired Package Boilers.
.2 CAN/CSA-B149.1-20, Natural Gas and Propane Installation Code.

.5 Canadian Standards Association (CSA International)

.1 CSA B51-03, Boiler, Pressure Vessel, and Pressure Piping Code.

.2 CSA B139-04, Installation Code for Oil Burning Equipment.

.3 CSA B140.7-05, Oil Burning Equipment: Steam and Hot-Water Boilers.

.4 CSA 149.6-22, Code for digester gas, landfill gas, and biogas generation and utilization

.6 CSD-1- Boiler burner and gas train shall have compliance.

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

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

.1 Material Safety Data Sheets (MSDS).

.9 NFPA:

.1 NFPA 54- National Fuel Gas Code

.2 NFPA 70- National Electric Code

.3 NFPA 211 “Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.”

.10 UL Compliance- Test boilers for compliance with cULus certification and be cULus labeled as a packaged boiler & burner. Boilers shall be listed and labeled and include label affixed to the equipment.

.11 SMACNA: Comply with SMACNA Low Pressure Duct Standards for fabricated breeching and smoke pipe.

.12 AWS: Comply with AWS Structural Welding Code for welder’s qualifications, welding details, and workmanship standards.

.13 ASHRAE: Comply with the ASHRAE Equipment Handbook for Chimney, Gas Vent, and Fireplace Systems, material requirements and design criteria.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

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

.2 Indicate the following:

.1 General arrangement showing terminal points, instrumentation test connections.

.2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.

.3 Foundations with loadings, anchor bolt arrangements.

.4 Piping hook-ups.

.5 Equipment electrical drawings.

.6 All miscellaneous equipment.

.3 Engineering data to include:

.1 Radiant heat loss at 100% design capacity.

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

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

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

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

.2 Include the following as a minimum:

.1 Operation and Maintenance Data: Operation and maintenance manuals shall contain dimension and wiring drawings, product data, operating instructions, cleaning procedures, maintenance and repair data, complete parts list, etc.

.2 ASME Stamp Certification and Report: Submit a copy of the inspection report and documentation of hydrostatic testing.

.3 Spare parts List: Recommended spare parts list with quantities for each.

.4 Manufacturer’s data reports.

.5 The specified factory tests have been satisfactorily performed.

.6 cULus Certification in the form of an affixed label to the equipment.

.7 Start-up reports proving satisfactory performance.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Work to be performed in compliance with applicable Provincial regulations.

.2 Manufacturer- Company specializing in manufacturing the products specified in this section with a minimum of twenty-five years of documented experience.

.3 Local Representation- Boiler vendor must have a local representative located within 100 km of the installation site and able to provide technical support as needed to ensure timely assistance and minimize downtime.

.4 Provide authorized factory representatives to conduct initial boiler start-up.

.5 Performance Testing Attendance-The boiler supplier’s representative attendance is mandatory during all performance tests to ensure compliance with specified operational requirements and assist with any adjustments.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Boilers will have to be brought into the No. 5 Boiler Room through existing overhead door. Contractor shall visit the site and determine how to bring in the boilers prior to tender closing and include all associated costs.

1.7 MAINTENANCE

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

.2 Extra materials:

.1 Spare parts for 1 year of operation.

Part 2 Products

2.1 BOILERS 5 and 6 (BLR-B0005 and BLR-B0006)

.1 General:

.1 Packaged boiler:

.1 Complete with necessary accessories and controls.

.2 Ready for attachment to piping, electrical power, controls.

.3 Designed and constructed to ANSI/ASME Boiler and Pressure vessel Code.

.4 CRN (Canadian Registration Number), to CSA B51.

.2 Performance:

.1 Boiler capacity: 2,000 kW (200 HP).

.2 Application: Hot Water

.3 Design Pressure: 200 psig.

.4 Operating Pressure: 112 psig.

.5 Boiler hot water temperature: 121°C (250 °F)

.6 Safety Relief Valve Set-point: 160 psig

.7 Fuel: Natural Gas and Digester Gas (dual fuel).

.8 Gas-Fired Boiler Emissions: Not to exceed allowable ambient air quality standards in governing jurisdiction and indicated values.

.1 Carbon monoxide:

.1 50 parts per million at any point from 100 percent to 50 percent firing rate.

.2 100 parts per million at any point below 50 percent firing rate.

.2 Nitrogen compounds: 30 parts per million (dry volume basis and corrected to 3 percent oxygen) at any point from 100 percent to low fire.

.3 Hydrocarbon and Volatile Organic Compounds: 20 parts per million (dry volume basis and corrected to 3 percent oxygen) at any point from 100 percent to low fire.

.4 Particulate Matter: 0.01 lb/MMBtu.

.9 Available Natural Gas Pressure: 5 psi

.10 Digester Gas:

.1 Based on provided site conditions:

.1 Methane (CH4): 61.8% by Volume

.2 Carbon Dioxide (CO2): 37.2% by Volume

.3 Hydrogen Sulfide (H2S): <200 ppm

.4 Saturated with Water: 5%

.5 Heating Value: 626 BTU/cu ft

.2 Minimum Digester Gas Pressure: Inlet pressure to the regulator must be at least 2 psig.

.3 HORIZONTAL FIRE-TUBE BOILERS:

.1 Dimensions and Weights:

.1 Dimensions: 1,918mm (W) x 5,804mm (L) x 2,210mm (H) (75 ½” (W) x 228 ½ ” (L) x 87” (H))

.2 Shipping Weight: 6577 kg (14,500 lbs)

.2 Clearances

.1 Rear door swing: 813 mm (32”)

.2 Tube removal, front: 4013.2 mm (158”)

.3 Sides: 1000 mm (40”)

.4 Boilers arrangement must satisfy the minimum required clearances shown on Drawings between and all around the boilers.

.3 Pressure Vessel: Dry-back or Water-back design with the following:

.1 Two (2) passes.

.2 Minimum Heat-Exchanger Surface: Supply five (5) square feet of heating surface per rated boiler horsepower to guarantee rated boiler capacity.

.3 Provisions for lifting boiler in-place.

.4 Base:

.1 Factory-mounted pressure vessel and other boiler components on steel saddles or supports that are fastened securely to a structural steel base that is constructed to make a complete self supported unit requiring only a flat level surface for support.

.2 Base included with attachments if required to secure boiler to structure.

.3 Manufacturer's standard provisions for lifting shall be sufficient to carry total weight of fully assembled boiler with a safety factor of 1.2.

.5 Shell:

.1 Horizontal, cylindrical, steel pressure vessel.

.2 Manholes and Handholes:

.1 Manhole for waterside inspection and access.

.2 Handholes at front and rear of boiler for waterside inspections.

.3 Hot Water Boilers:

.1 Connections for water outlet including dip tube, water inlet, air vent and level controls.

.2 Connections for safety relief valve(s), drain, and exhaust stack.

.6 Furnace:

.1 Welded cylindrical steel chamber that is welded to steel tube sheets.

.2 Arranged to provide uniform heat distribution under all firing conditions with no flame impingement on any refractory-covered or dry-backed surface.

.3 Surrounded by water without interfering with natural circulation of water within shell.

.4 Positioned from shell to inhibit unequal thermal stresses during operation.

.7 Fire Tubes:

.1 Steel, seamless or resistance welded.

.2 Fitted in sized holes in tube sheets and rolled, beaded or welded in place.

.3 Removable from one end of boiler on waterback boilers and on both ends on dryback boilers.

.4 Provided without spinners, turbulators, and other inserted devices.

.8 Flue:

.1 Flanged connection located along top centerline and near the front of the boiler. The exhaust gas flue connection shall be capable of supporting a field-installed flue stack with a weight of:

.1 125-800 hp: 2000 pounds

.2 Equip boiler flue with bimetal thermometer in a stainless-steel thermowell and nominal 5-inch diameter face having a graduated scale and range of approximately 1.5 times the outlet temperature. Mount thermometer in a visible location to indicate flue-gas temperature.

.9 Front and Rear Doors:

.1 Hinged and davited, sealed with super-wool insulation and fastened tightly using locking lugs on steel studs.

.2 Designed so tube sheets and flues are fully accessible for inspection or cleaning when doors are open without the need to disconnect burner, blower, and fuel piping.

.3 Include observation ports in doors at both ends of boiler for inspection of flame conditions.

.4 Door insulation and refractory shall be accessible for inspection and maintenance.

.5 The waterback boiler rear head shall be fitted with a refractory access plug for rear fireside inspection.

.6 Reinforce doors of dryback boilers to limit deflection due to thermal stresses and burner combustion pulsations to prevent progressive cracking and loosening of refractory.

.10 Insulation:

.1 Minimum 2-inch-thick, mineral-fiber insulation surrounding the boiler shell and secured in place to prevent sagging or displacement.

.2 Insulation of sufficient density or attached with reinforcement to prevent permanent deformation of protective jacket when subjected to an impact force and forces associated with service personnel walking, kneeling, and laying on boiler while performing service.

.11 Jacket: Sheet metal, with factory-applied protective finish.

.1 Nominal Thickness: Not less than 0.048 in.

.2 Consisting of multiple removable painted sections attached with corrosion-resistant screw-fasteners to facilitate removal and replacement multiple times.

.4 GAS TRAINS:

.1 Provide separate boiler valve gas trains for digester gas and natural gas to conform with CSA B149.1, CSA B149.3 and CSA B149.6.

.2 The gas train shall consist of a pressure regulating electro-hydraulic proportional air/gas main gas actuator providing a slow opening, fast closing shutoff valve and proportional 1:1 air/gas ratio control, a fast-closing safety shutoff gas solenoid, and a low gas pressure switch. A factory pre-set combination metering valve and orifice shall be provided for setting combustion parameters. Turndown ratio 4:1.

.5 BURNER

.1 Dual Fuel - Natural Gas and Digester Gas-Fired:

.1 Furnish Cleaver Brooks dual-canister burner housing for firing both natural gas and digester gas. The burner shall be completely assembled, wired and factory tested. The complete Burner System shall be listed by

Underwriters Laboratories and, if Low NOx is required, have individual UL labels on the major Low NOx system components, i.e. FGR (Flue Gas Recirculation) shutoff valve assembly, FGR metering valve, and panel, proving the total system to be certified.

.2 A supplier shall not be allowed to furnish a standard UL approved Non-FGR Burner and “field mount” the Low NOx FGR parts, in an effort to circumvent the intent of Underwriters Laboratories for a total Low NOx FGR system approval.

.3 Systems which use a separate FGR fan assembly to force FGR into the burner and/or combustion chamber during normal burner “run” shall not be acceptable.

.2 Burner type - The burner shall be integral with the front head of the boiler and of the high radiant, dual canister multi-port type for two different gasses. The dual Canister burner shall be designed to assure that each fuel is introduced to the combustion process through a separate orifice ring that is each sized based of the fuel specification to optimize combustion performance through out the 4:1 firing range. Means shall be provided to cool the Digester Gas portion of the Dual Canister Burner ring whenever Natural Gas is firing.

.3 Gas Pilot - The gas pilot shall be a premix type with automatic electric ignition. An electronic detector shall monitor the pilot so that the primary fuel valve cannot open until pilot flame has been established. The pilot train shall include one manual shut-off valve, solenoid valve, pressure regulator and one plugged leakage test connection.

.4 Gas Burner:

.1 Gas Burner Piping - Gas burner piping shall comply with Canadian Standards Association (CGA) B105 code for Digester Gas Systems. This shall include 316 or 316L stainless steel piping and, when required, nuts and bolts for flanges shall be 304 stainless steel. Pipe size 3" and over shall be flanged connections. Safety Valves shall include two corrosion resistant electrically operated types, both valves shall include a 'proof-of-closure' feature to be interlocked with the burner sequence controller to prevent burner operation if either valve is not fully closed. Two CSA approved manually operated plug valves shall be provided. High and Low Gas pressure switches shall be provided that is designed and warranted for Digester Gas Service including Teflon actuator seals and Factory Mutual approved. Gas pressure test connections shall be provided immediately upstream of the burner, downstream of each automatic safety shut-off valve and downstream of the regulator. A flame arrester shall be included. The size of the Digester Gas train shall be dependent upon the Digester Gas pressure available at the inlet to the burner gas pressure regulator. A lock-up type of regulator shall be provided if the supply pressure exceeds 14" W.C. A separate actuator shall be provided to control the Digester Gas flow rate via a butterfly valve. The package boiler/burner UL of C label is not available due to the utilization of Digester Gas. All electrical components other than gas valves will have individual UL ratings.

Burner Turndown - Digester Gas will limit the burner turndown to 4:1 in order to maintain flame stability at minimum firing rates. This 4:1 limitation is for both Digester and Natural Gas (if Natural Gas is used as a secondary fuel source).

.6 BLOWER:

.1 Air for combustion shall be supplied by a forced draft blower incorporated into the burner design to eliminate vibration and reduce noise level.

.2 The impeller shall be fabricated or cast aluminum with radial blade, carefully balanced, and directly connected to the blower motor shaft. Shaft grounding ring shall be supplied on motors greater than 75hp.

.3 Blower and drive assembly shall be controlled through boiler's integral controls in response to boiler manufacturer's prescribed sequence of operation and coordinated with burner and fuel train to achieve performance indicated.

.1 Where indicated or required to achieve performance, provide blower with unit-mounted variable frequency controller to vary blower speed in response to prescribed control set point and changes in operating conditions.

.2 Variable-speed fan operation shall be checked for resonant frequencies and adjusted to provide no resonant frequencies throughout entire operating range.

.4 Motor:15 HP

.5 Voltage: 575/3/60

.7 BOILER TRIM:

.1 Boiler Trim Arrangement

.1 Boiler 5 (BLR-B005)

.1 When viewed facing front head of boiler, the Digester gas train is located on the right side of the boiler and Natural gas train is located on the left side of the boiler.

.2 Boiler 6 (BLR-B0006)

.1 When viewed facing front head of boiler, the Digester gas train is located on the left side of the boiler and Natural gas train is located on the right side of the boiler.

.2 Safety Relief Valves:

.1 Size and Capacity: As required for equipment according to the most recent edition of the ASME Boiler and Pressure Vessel Code.

.2 Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

.3 Pressure Gage: Nominal 6-inch diameter face with graduated scale and siphon, with isolation valve to indicate pressure vessel pressure.

.4 Temperature Gauge: Nominal 6-inch diameter face with graduated scale and siphon, with isolation valve to indicate hot water temperature.

.5 Drain valve: Provide drain valve and an option for factory mounting.

.6 Blend pump when required, shipped loose and an option for factory mounting.

.8 CONTROLS

.1 Boiler operating controls shall include the following devices and features:

.1 Control transformer with fuse protection, as required by manufacturer, to implement requirements indicated. Provide transformer with 20 percent spare capacity.

.2 Temperature Control for Hot Water Boilers:

.1 Operating Limit Control: Factory wired and mounted to control boiler to maintain boiler at constant temperature (auto reset).

.2 High Limit Cutoff: Factory wired and mounted to stop burner if operating conditions rise above normal operating set point (manual reset).

.3 Firing Rate Control: Factory wired and mounted used to change the burner-firing rate to adjust to water temperature requirements.

.3 Water-Level Control for Hot Water Boilers:

.1 Low Water Cutoff: A low water cutoff control (manual reset) shall be mounted on the top centerline of the boiler wired into the burner control circuit, to prevent burner operation if boiler water falls below a safe level.

.4 Boiler Emergency Shutdown: Interlock with field-installed boiler emergency shutdown switch to shut down boiler when activated.

.1 Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for emergency conditions.

.5 Burner Flame Safeguard Controls:

.1 Factory equipped with flame safeguard control and infrared flame scanner.

.2 Microprocessor-based, solid-state control having sequence and flame-on visual indication and fault code indications of flame safeguard trip functions.

.3 Control shall include dynamic self-check logic.

.4 Control shall have a fixed operating sequence incapable of being manually altered that includes start, prepurge, pilot and main fuel ignition run, and postpurge cycles.

.5 Control shall be non-recycle type for maximum safety that shall shut down the burner and indicate, as a minimum, the following trip functions:

.1 Pilot and main flame failure.

.2 High- and low-fire proving switch faults.

.3 Running interlocks open.

.4 False flame signal and fuel valve open.

.6 Control shall include a run/test switch to allow interruptions to sequence just after prepurge and during pilot ignition trial, and run cycles for adjustments to firing rate motor, damper linkages, and pilot flame for minimum turndown tests.

.6 Automatic Fuel Changeover:

1. The system shall include a digester gas pressure transmitter and automatic fuel changeover system, allowing the boiler to switch to natural gas when digester gas pressure falls below a set threshold.
2. The control system shall preferentially fire digester gas when adequate pressure is available. If the digester gas pressure drops, the system will automatically switch to natural gas after performing the necessary pre-purge and post-purge sequences.
3. The control system shall include a local LCD display and HART communication protocol for pressure readings.

.7 Combustion-Air Controls: Factory equipped with motor-operated combustion-air damper and blower control to regulate burner fire according to load demand.

.8 Control Options:

.1 Oxygen Trim System: Continuously monitor and display oxygen concentrations in boiler flue gas and adjust fuel and airflow to maintain an adjustable oxygen-level set point. System shall compensate for changes in ambient temperature, barometric pressure, humidity, and variations in fuel characteristics.

.2 Remote IoT Monitoring: Provide boiler data monitoring via a cellular network, which does not require remote access to the customer's

network. Cellular data communication shall be secure and one-way communication only.

.9 Integrated Boiler-Control System:

.1 Integral control of burner management for flame safety, boiler modulation, and operator interface functions with features and functions indicated.

.2 Factory preconfigured.

.3 Utilizing PLC based controls and sensors to provide various control functions, including the following:

.1 Automatic sequencing of the boiler through standby, prepurge, pilot flame establishing period, main flame establishing period, run, flame proving and lockout, and postpurge.

.2 Full modulating control of air and fuel through Proportional-Integral-Derivative (PID) algorithm.

.3 Thermal shock protection.

.4 High and low limit alarms and shutdowns.

.4 Local operator interface through nominal 12-inch color touch screen graphical display for setup, monitoring, and data acquisition.

.1 Manual control of the boiler firing rate using control screens to increment or decrement firing rate.

.2 Indication of burner management controller status and diagnostics.

.3 Display of system alarms and faults.

.4 Display of history of alarms and faults.

.5 Display of recommendations for troubleshooting of fault conditions.

.6 Stack flue-gas, combustion-air, and shell water-temperature indication.

.7 Boiler efficiency calculation and display.

.8 Low-fire hold with minimum temperature control.

.9 Assured low-fire cutoff (ALFCO).

.10 High stack temperature annunciation with auto cutoff.

.11 Audible alarm and silencing through touch screen intervention.

.5 Fully integrated control of the following:

.1 Blower operation and combustion-air damper for varying operating conditions.

.2 Oxygen trim and monitoring to compensate for combustion-air variations.

.3 Parallel positioning for independent fuel and air control for enhanced fuel efficiency.

.4 Multiple boiler lead/lag control with hot standby.

.10 Digester Gas Strainer Differential Pressure Alarm.

.11 Control Enclosures:

.1 NEMA Type 12,

.1 Provide enclosure with integral vents, fans, heater, and air conditioner as required to automatically control temperature

inside enclosure within safe operating limits of devices installed within the enclosure.

.2 Mounted on boiler assembly at a location convenient to operator.

.3 Provide hinged full-size door with latch and closure.

.4 Enclosure shall consist of multiple sections divided by a partition with a separate hinged door for each section. One section shall house low-voltage controls and other section shall house line voltage controls.

.5 Enclosure shall house the following:

.1 Control transformers with fuses.

.2 Labeled terminal strips.

.3 Controller(s) to provide control and alarm functions indicated.

.4 Audible indication of safety alarms.

.6 Face of enclosure shall provide the following:

.1 Visual indication of operating components and alarms.

.2 Auto/local capability to allow operator to manually operate boiler locally.

.3 Audible alarm-silence capability.

.4 Labels for switches, lights, and displays to provide clear indication of service.

.7 Control Instrument Enclosures: Control instruments and devices that are mounted on the boiler assembly and cannot be installed inside the control enclosure shall have same or higher level of protection indicated for control enclosures.

.8 Control Cable and Wire:

.1 Control cable and wiring shall be numbered and color-coded to match wiring diagram.

.2 Install cable and wiring located outside of enclosure(s) in a metal raceway. Use flexible conduit to make final terminations.

.9 ELECTRICAL POWER:

.1 Voltage: 575v / 3ph / 60 hz

.2 Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

.1 Enclosure: Type 12,

.1 Enclosure shall have integral vents, fans, heat, and air conditioner as required to automatically control temperature inside enclosure within safe operating limits of devices installed within the enclosure.

.2 Mounted on boiler assembly at a location convenient to operator.

.3 Enclosure shall have hinged full-size door with latch and closure.

.2 Wiring shall be numbered and color-coded to match wiring diagram. Provide a wiring diagram located inside enclosure.

.3 Install wiring outside of an enclosure in a metal raceway. Make final connections to motors using flexible conduit.

.4 Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.

.5 Provide each motor with NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection. Provide variable-frequency controller

with manual bypass and line reactors for each variable-speed motor indicated.

.10 FINISH

.1 General:

.1 Paint boiler, using manufacturer's standard procedures, except comply with requirements indicated.

.2 Miscellaneous surfaces shall be finished to match continuous surfaces.

.3 Contractor shall field touch up or entirely repaint surface finishes, if damaged during shipment, to original condition, using original materials and methods.

.4 Paint shall be suitable for temperatures encountered on painted surfaces.

.5 Requirements indicate minimum quality level. Provide more robust paint system if required.

.2 Do not paint aluminum or stainless steel.

.11 Acceptable Product: “Cleaver Brooks” model CBLE-2D-700-200-150HW, custom built as CBLE-2D to increase flue gas temperature for operating with digester gas, c/w all specified options and accessories, or approved equivalent in accordance with B7.

2.2 LADDER AND PLATFORM

.1 Boiler 5 and 6 (BLR-B0005 and BLR-B0006)

.1 Located on the right side of the boiler. Ladder to be at the rear of the platform, but still on the right side of the boiler.

.2 Ladder to be extended an additional of 6 inches to account for the concrete pad on which the boiler is placed.

.3 Design ladder and platform according to general arrangement shown on drawings, ladder must be located to maintain minimum clearance indicated around boiler.

2.3 BREECHINGS & STACKS

.1 Manufacturers: subject to compliance with requirements, provide all steel, positive pressure double wall vents

.2 The factory built breeching system shall be made in accordance with NFPA 211. This stack system shall be designed and installed to be gas tight. It shall be UL Listed to withstand up to 60" w.c. positive pressure. This breeching system shall be designed to compensate for all flue gas induced thermal expansions. Mineral Fiber insulation between inner and outer pipe shall be 1 inch thick. Clearances to combustible materials shall be per installation instructions and shall have been determined for a continuous operation at temperatures up to 1000^{o}F.

.3 The joint assembly shall be a male/female slip-type jointing with flange to flange and V-band assembly. An internal sleeve serves for readily alignment as well as long term joint seal protection from condensate, water and flue gas temperature. Non-slip type joints are not acceptable.

.4 The double wall stack has an inner gas carrying pipe of 20 gauge type 304 stainless steel. The outer jacket shall be 24 gauge 304 stainless steel. The materials and construction of the modular sections and accessories shall be as specified by the terms of the product’s UL Listing.

.5 The entire stack system from each boiler to the termination, including accessories, shall be from one manufacturer.

.6 The breeching and stack shall be warranted against functional failure due to defects in material and manufacturer's workmanship for a period of 15 years from the date of delivery.

.7 Drawings showing the actual layout and drawn to scale shall be provided by the manufacturer. The system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer's 15 year warranty and in conjunction with sound engineering practice.

.8 The inner diameter for breeching and stack shall be verified by the manufacturer's computations. The computation shall be technically sound, shall follow ASHRAE calculation methods and incorporate the specific flow characteristics of the inner pipe.

.9 Technical services supports. The factory built modular stack system shall be furnished by a vendor organization which assures design, installation and service coordination and provides in-warranty and post warranty unified responsibility for the City.

.10 Acceptable material: Cheminee Lining E Inc, Model IPPL1 or approved equivalent in accordance with B7.

Part 3 Execution

3.1 EXAMINATION

.1 Before boiler installation examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations and piping and electrical connections to verify actual locations, sizes and other conditions affecting boiler performance, maintenance and operations.

.1 Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

.2 Examine mechanical spaces for suitable conditions where boilers will be installed.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

.1 Install boilers level on concrete bases or floors. Provide stainless steel levelling shims as required on existing floors. Anchor according to manufacturer recommendations.

.2 Install gas-fired boilers according to NFPA 54.

.3 Assemble and install boiler trim.

.4 Install electrical devices furnished with boiler but not specified to be factory mounted.

.5 Install control wiring to field-mounted electrical devices.

.6 Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.

.7 Make required piping connections to inlets and outlets recommended by boiler manufacturer.

.8 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.9 Mount unit level.

.10 Provide external low water cut-off.

.11 Comply with all requirements of the Authority Having Jurisdiction (Inspection and Technical Services Manitoba).

.12 Provide propane piping per CSA B149.1 Natural Gas and Propane Installation Code.

.13 Provide digester gas piping per CSA 149.6-22 Code for digester gas, landfill gas, and biogas generation and utilization

3.3 CONNECTIONS

.1 Piping installation requirements are specified in other Division 23 sections. Drawings indicate general arrangement of piping, fittings and specialties.

.2 Install piping adjacent to boiler to permit service and maintenance.

.3 Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

.4 Connect gas piping to boiler gas-train inlet with unions. Piping shall be at least full size of gas train connection. Provide a reducer if required.

.5 Connect hot-water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

.6 Install piping from safety relief valves to relief valve separator tank.

.7 Boiler Venting

.1 Install flue venting kit and combustion-air intake.

.2 Connect venting full size to boiler connections.

.8 Provide condensate neutralizer kits and install per manufacturer’s instructions. Pipe to drain using 316L stainless steel drain lines.

.9 Ground equipment according to Section 26 05 28 Grounding – Secondary.

.10 Connect wiring according to Section 26 05 21 Wire and Cable.

3.4 FIELD QUALITY CONTROL

.1 Perform tests and inspections and prepare test reports.

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.

.2 Tests and Inspections

.1 Perform installation and start-up checks according to manufacturer's written instructions.

.2 Perform hydrostatic test. Repair leaks and retest until no leaks exist.

.3 Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

.4 Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

.1 Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.

.2 Set field-adjustable switches and circuit-breaker trip ranges as indicated.

.3 Remove and replace malfunctioning units and retest as specified above.

.4 Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance adjusting system to suit actual conditions. Provide up to two visits to site for this purpose.

.5 Performance Tests:

.1 The boiler manufacturer is expected to provide partial load thermal efficiency curves. These thermal efficiency curves must include at least three separate curves at various BTU input levels. If these curves are not available, it is the responsibility of the boiler manufacturer to complete the following performance tests:

.2 Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.

.3 Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.

.4 Perform field performance tests to determine capacity and efficiency of boilers.

.1 Test for full capacity.

.2 Test for boiler efficiency at low fire, 20, 40, 60, 80, 100, 80, 60, 40 and 20 percent of full capacity. Determine efficiency at each test point.

.5 Ensure that the dual-fuel system is tested for both natural gas and digester gas operation.

.6 Automatic fuel changeover from digester gas to natural gas should be tested to ensure seamless transitions under varying pressure conditions

.7 Repeat tests until results comply with requirements indicated.

.8 Provide analysis equipment required to determine performance.

.9 Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.

.10 Notify Contract Administrator in advance of test dates.

.11 Document test results in a report and submit to Contract Administrator.

.12 Contractor and manufacturer to provide training in accordance with section 01 79 00 – Demonstration and Training

3.5 MANUFACTURER'S INSTRUCTIONS

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

.2 Install all field mounted components, sensors, devices, etc. per manufacturers installation instructions.

3.6 MOUNTINGS AND ACCESSORIES

.1 Safety valves and relief valves:

.1 Run separate discharge from each valve.

.2 Terminate discharge pipe as indicated.

3.7 TRIAL OPERATION PRIOR TO SUBSTANTIAL PERFORMANCE

.1 Minimum of three consecutive days of continuous satisfactory operation for each boiler is required prior to acceptance.

.2 Supply labour, materials and instruments required for trial tests.

3.8 OPERATIONS AND MAINTENANCE RESPONSIBILITY

.1 Contractor is responsible for operation and maintenance of the boilers from the time of start-up to the date of Substantial Performance.

.2 The City shall take over the operation and maintenance of the boilers from the date of Substantial Performance and onwards.

3.9 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 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, latest adopted edition

.2 CSA C22.2.

.3 CAN3-C235-83, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 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.

.3 City of Winnipeg Standards

.1 WSTP Automation Design Guide Rev 03 (612620-0013-40ER-0001)

.2 WWD Identification Standard Rev 04

.3 WWD Electrical Design Guide Rev 05 (510276-0000-47ER-0001)

.4 WSTP Tag Naming Standard Rev 00 (612620-0014-40ER-0001)

1.2 RELATED SECTIONS

.1 This Section covers items common to Sections Division 26, Electrical.

1.3 ELECTRICAL SUBCONTRACTOR REQUIREMENTS

.1 Comply with all Department of Labour, Workplace and Health requirements at all times.

.2 All contractors shall have a valid license to operate in the City of Winnipeg.

.3 The complete installation shall be carried out in neat and workmanlike manner to the satisfaction of the Contract Administrator.

.4 All Electrical Subcontractor employees on Site shall have valid Trade Licenses.

.5 Electrical Subcontractor shall maintain the appropriate ratio of Journeymen Electricians & Apprentices required by Provincial Codes. Only qualified workmen shall be employed on this contract. Supervision shall be by Journeymen Electricians and Work carried out by Journeymen and/or registered apprentices only.

.6 Obtain all necessary permits & pay all fees and arrange for inspection with City of Winnipeg.

.7 Obtain a certificate of final inspection and approval from inspection department having jurisdiction on completion of Work.

.8 All materials, tools, appliances, scaffolding, apparatus and labour necessary for the execution, erection and completion of specified systems shall be furnished.

.9 Provide all labour and materials necessary for complete and operating systems as indicated on the drawings and specified herein. Any Work and material, even if not

shown or specified, which is obviously necessary or reasonably implied to complete the Work shall be provided as if it was both shown and specified.

.10 Unless otherwise specifically noted, any issues which are not part of electrical / telecommunication area of expertise, even if mentioned in these documents, are indicated only for reference and coordination purposes only (with other trades). The Electrical Subcontractor shall consult with all other sub-trades involved to confirm the locations of the various outlets and equipment and shall cooperate fully to ensure that no conflict arises during the installation. In case of any difference of opinion, the matter shall be referred to the Contract Administrator for final decision.

.11 Electrical Subcontractor is responsible for arranging and coordinating with other divisions for proper drainage of electrical conducts entering from outside, drainage of all exterior electrical junction and pull boxes, sealing and waterproofing of all electrical penetrations; methods of firestopping, and envelope penetration.

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 All electrical design drawings, details and specifications are diagrammatic, and unless specifically noted by figured dimensions, indicate the general arrangement of receptacles, light fixtures, switches, risers, panels, etc. Any information involving accurate dimensions, shall be obtained from detailed dimensioned drawings or by actual measurements at the building. If doubt exists as to the final location, the Electrical Subcontractor shall contact the Contract Administrator for clarification prior to installation. The location of switches, receptacles, outlets, etc., shall be coordinated with built-in units, appliances and equipment, mechanical equipment, etc., as shown on the architectural and mechanical drawings and/or as existing.

.2 Where space is indicated for future equipment, leave such space clear and install feeders and equipment pertaining to this contract in such a way that future equipment can be easily installed.

.3 Electrical Subcontractor shall coordinate locations of lighting fixtures with sprinklers, mechanical ducts, diffusers, beams and other architectural, structural and mechanical items. Any relocation required shall be performed at no cost to the City.

.4 Operating voltages: to CAN3-C235.

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

1.6 PLANS

.1 The Electrical Subcontractor shall familiarize them self with the plans which show the approximate locations of outlets and apparatus. The right is reserved to make such changes in location as may be necessary to meet contingencies of construction. No extras will be allowed for such changes to any piece of electrical equipment, outlets, etc.

.2 Should a discrepancy appear between plans, specifications, or the actual conditions encountered on the Site, which leaves the Electrical Subcontractor in doubt as to the true

intention and meaning of the plans and specifications, a ruling shall be obtained in writing from the Contract Administrator which will be final.

1.7 SUBMITTALS

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

.2 Shop drawings:

.1 Prior to manufacturing any item required for this job, the Electrical Subcontractor shall submit detailed shop drawings of the item. 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.

.2 Shop drawings must be received by the Contract Administrator at a date early enough to permit reasonable study prior to review and manufacturer, or to permit alterations where necessary. Facsimile transmission of shop drawings will NOT BE ACCEPTED. Late submissions of shop drawings will be sufficient reason for stoppage of construction pending review, or removal and replacement of any unsatisfactory item at the Electrical Subcontractor's expense.

.3 Electrical Subcontractor shall allow a minimum of ten (10) business days for shop drawing review by the Contract Administrator and time shall be incorporated in construction schedule so no delays occur due to late submission of shop drawings.

.4 Shop drawings shall be submitted by email, bearing Electrical Subcontractors' signatures. All shop drawings shall be stamped by the Electrical Subcontractor prior to submission. Prints will be returned with review stamp and/or appropriate comments.

.5 Shop drawings shall be reviewed by the Contract Administrator. Corrections or comments made on the shop drawings during this review do not relieve Electrical Subcontractor from compliance with requirements of the drawings and specifications. This review is only for the general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Electrical Subcontractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his or her Work with that of all other trades and performing all Work in a safe and satisfactory manner.

.6 Shop drawings shall be provided for all system components.

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

.1 Any electrical material and/or equipment supplied by Contractor or Subcontractors for installation on this project must bear evidence of certification by authorized organization (e.g. CSA) or special certification acceptable to the Chief Inspector of Electrical Energy for the Province of Manitoba.

.2 Any material and/or equipment not complying with this requirement and found on the job Site will be subject to rejection and replacement with approved equipment at no additional cost.

.3 Electrical Subcontractor, upon receipt of equipment purchased by the City for installation on this project, shall examine it for compliance with the above requirements. Report any non approved equipment to the Contract Administrator for action. Such equipment shall be returned to its packing crate until instructions are received from the Contract Administrator.

.4 Submit test results of installed electrical and telecommunication systems.

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

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.

.4 Substitutions:

.1 Unless otherwise noted on the plans or specifications, substitutions may be allowed by the Contract Administrator, when requested by the Electrical Subcontractor or by equipment suppliers, for items specified by manufacturer and catalogue number.

.2 Requests for review of such substitutions shall be submitted via email at least seven working days prior to the Bid date. Facsimile transmission of substitution drawings and/or specifications will NOT BE ACCEPTED.

.3 Descriptive catalogue sheets accompanying the approval application which may show several items of varying specifications shall be conspicuously marked in such a manner that the offered substitute item may easily be recognized for comparison.

.4 Proposed substitutions must be at least of equal quality to that of the specified item. The manufacturer's specification of the item shall apply for comparison if no other clause of this specification applies. The Contract Administrator will review substitution proposal and will make final decision for the City.

.5 Off-the-shelf items which are specified by description only, without any manufacturer, model type or catalogue number, do not require approval prior to the Bid date. However, Electrical Subcontractor shall submit to the Contract Administrator a request for review of such items prior to their use, in sufficient time to permit rejection if unsatisfactory.

.6 All additional expenses incurred as a result of substitution will be the direct responsibility of the Electrical Subcontractor.

.5 O&M Manuals:

.1 Submit O&M manuals in a binder complete with warranty certificate, closed out permit, as-builts, and equipment specification sheets.

1.8 QUALITY ASSURANCE

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

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Acts respecting manpower vocational training and qualification.

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

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 11 - Cleaning.

1.10 SYSTEM STARTUP

.1 Instruct Operating Personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service technician 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 will aspects of its care and operation.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to Site and submit such approval as described in PART 1 - SUBMITTALS.

.2 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

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

.2 Control wiring and conduit: in accordance with 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.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction and Contract Administrator.

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

2.4 WIRING TERMINATIONS

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

2.5 EQUIPMENT IDENTIFICATION

.1 All equipment shall be identified as per WWD Identification Standard Rev 04 and WSTP Tag Naming Standard Rev 00 (612620-0014-40ER-0001).

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

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

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters

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

.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. Eg. “P600”

.8 Terminal cabinets and pull boxes: indicate system and voltage.

2.6 WIRING IDENTIFICATION

.1 All wiring shall be identified as per All equipment shall be identified as per WWD Identification Standard Rev 04 and WSTP Tag Naming Standard Rev 00 (612620-0014-40ER-0001).

.2 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.3 Maintain phase sequence and colour coding throughout.

.4 Colour coding: to CSA C22.1.

.5 Use colour coded wires in communication cables, matched throughout system.

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

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 All conduit and cable shall be identified as per All wiring shall be identified as per All equipment shall be identified as per WWD Identification Standard Rev 04 and WSTP Tag Naming Standard Rev 00 (612620-0014-40ER-0001).

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

.3 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 5 m intervals.

2.8 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 outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

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

.2 The Electrical Subcontractor shall obtain and ascertain information from all other sub-trades as to the extent and details of any additional electrical Work to complete all systems served with electrical power or controlled electrically and, where necessary, allow in his Bid for such Work. No extra claim will be accepted for Work on such systems whether they are; as specified in architectural, structural, landscape or mechanical plans and specifications; or proposed and accepted as alternate systems.

.3 Any electrical and communication Work carried out on behalf of, or by, other Subcontractors shall be in accordance with the regulations of the Canadian Electrical Code and the applicable clauses of this specification.

.4 It shall be the Electrical Subcontractor's responsibility to ensure that all Subcontractors and suppliers of electrical equipment observe the applicable clauses of the electrical specifications.

.5 In case of differences between Subcontractors regarding extent of Work responsibilities, such matters shall be referred to the Contract Administrator through the Electrical Subcontractor. Should any discrepancy between the specification and drawings leave the Electrical Subcontractor in doubt as to the true intent and meaning, a ruling shall be obtained from the Contract Administrator before the Bid is submitted. If this is not done it will be the Electrical Subcontractor’s responsibility to ensure that the more expensive alternate has been included.

.6 Prior to the Bid, the Electrical Subcontractor shall visit the Site and report to the Contract Administrator any condition which might prevent him from performing his contract as specified. No extra will be allowed for if this procedure is not followed.

.7 Should any Work or material be needed which is not specified or shown on the drawings and is nevertheless necessary for properly carrying out the obvious intent, such Work or materials shall be provided without additional cost.

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: schedule 40 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 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 Wall receptacles:

.1 In mechanical rooms: 1400 mm.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.6 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 1.7 - 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 in accordance with Section 01 45 00 - Quality Control.

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

.2 Circuits originating from branch distribution panels.

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

.4 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.

3.7 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 22 and 23. Motor horsepower ratings shall be as shown in Division 22 and 23 specifications. Motor voltage and phase ratings by Division 26.

2.2 EXTERIOR EQUIPMENT

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

Part 3 Execution

3.1 POWER WIRING

.1 Install power feeders, starters, 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 22 and 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 22 and 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 22 and 23, regarding wiring controls, overload heaters, equipment ratings and over-current protection. Notify the Division 22 and 23, at once, if any information provided is incorrect or unsatisfactory.

.3 Refer to Division 22 and 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 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2 No.65, Wire Connectors.

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

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.3 RELATED WORK

.1 Section 26 05 00 Common Work Results

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

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

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

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper or copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper or copper alloy sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured cable, aluminum sheathed cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.Execution

2.2 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.

.4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 26 05 00 - Common Work Results

1.2 PRODUCT DATA

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

1.3 SCOPE OF WORK

.1 Provide a complete system of wiring system, making all required connections as indicated on the drawings, specified herein and as required. Unless noted as larger, install and rate all cables and conductors in accordance with the requirements of the current edition of the Canadian Electrical Code.

.2 Unless otherwise noted, all systems in the building shall be wired in conduit.

Part 2 Products

2.1 Building Wires

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

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

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.

.8 Connectors:

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

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 Cable

.1 Conductors: 16 AWG, 7 strand concentric lay, Class B tinned copper, twisted pairs/triads.

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

.3 Twisted pairs/triads cabled with staggered lays.

.4 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.

.5 Armour: interlocking aluminum.

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

.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. .

.8 Connectors:

.1 Watertight, explosion proof approved for armoured cable.

2.6 Type Rw90 Conductor

.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.

Part 3 Execution

3.1 General

.1 Refer to City of Winnipeg Electrical Design Guide for separation requirements between cables.

.2 Redundant cables providing supply to the same load such that failure of one cable does not compromise the operation of the system, shall be separated to the greatest extent possible. At minimum, the cables must be in separate raceways and 1m apart.

3.2 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.

3.3 Installation Of Teck Cable 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

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

3.4 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.

3.5 Installation Of Control Cables

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

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

.1 ANSI/IEEE 837-1989, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

1.3 SCOPE OF WORK

.1 Provide all labour and material to constitute a complete system, equipment grounding and bonding.

.2 Ground all components of the electrical system in accordance with the requirements of the Canadian Electrical Code, local authorities and, where more stringent, manufacturers' requirements.

.3 Securely and adequately ground all components of the electrical system in accordance with the requirements of the CEC and additional requirements set up in the contract documents.

.4 The system shall consist of, but not be limited to cables and supports and all necessary materials to provide a complete system.

Part 2 Products

2.1 EQUIPMENT

.1 Insulated grounding conductors: green, type RW90.

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

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

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

.2 All locknuts, connectors and couplings shall be tight fitting and properly cinched, throughout the entire electrical distribution system for grounding and bonding purposes as required by the CEC.

.3 Ground Connections:

.1 When making ground and bonding connections, apply a corrosion inhibitor to contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between metals used.

.4 All joints between conductors of #6 AWG and larger shall be made with "Cadweld" process. Special permission from Contract Administrator is required where bolted pressure lugs or screw type "Hydent" connectors are installed.

.5 All bolted ground connections must be accessible.

.6 Install rigid PVC conduit sleeves where ground wires pass through concrete slabs.

.7 Connect grounding conductors to motors 10 hp and above or circuits 20A or above, with a solderless terminal and a bolt tapped to motor frame or equipment housing. Connect to smaller motors or equipment by fastening terminal to a connection box. Connect junction boxes to equipment grounding system with grounding clips mounted directly on box or with machine screws. Completely remove paint, dirt, or other surface coverings at grounding conductor connection points so good metal-to-metal contact is made.

.8 Install bonding wire in all flexible conduit connected at each end to a grounding bushing by a solderless lug, clamp, cup washer and screw. Soldered joints not permitted.

.9 Install #4 AWG bond wire along the full length of cable trays and between separate sections of trays and bond cable tray as required.

.10 Ground conductors not sized on drawings are to be sized in accordance with local governing electrical authority requirements. Ground conductor size is to be no smaller than requirements specified herein this article or on drawings.

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

.12 Protect exposed grounding conductors from mechanical injury.

3.2 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 the local inspection authority. A report shall be submitted to the Contract Administrator from the testing agency.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator, if provided, during tests.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 26 05 00 Common Work Results

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended, set in poured concrete walls and ceilings.

.2 All hardware, supports and channels shall be hot dipped galvanized.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead shields. Use Aluminum shields or as approved by anchoring manufactures recommendations for specific surfaces.

.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 where above 2700mm.
- .2 Two-hole steel straps to secure surface conduits and cables 50 mm and smaller where below 2700mm.
- .3 Two-hole steel straps for conduits and cables larger than 50 mm.
- .4 Beam clamps to secure conduit to exposed steel Work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 2 m on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1, Canadian Electrical Code (CEC), Part 1, Latest adopted edition

1.2 RELATED WORK

.1 Section 26 05 00 - Common Work Results

1.3 REFERENCES

.1 CAN/CSA C22.2 No. 18.1 Metallic Outlet Boxes.

.2 UL 514C Non-Metallic Outlet Boxes, Flush Device Boxes and Covers.

.3 Latest issue of CSA C22.1 Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 Boxes to be hot dip galvanized to ASTM a924(M), designation zinc coating Z180 (G60).

.3 102 mm square or larger outlet boxes as required for special devices.

.4 Gang boxes where wiring devices are grouped.

.5 Blank cover plates for boxes without wiring devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

.7 All electrical boxes and fittings shall be sprinkler proof.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished tile walls.

2.3 MASONRY BOXES

.1 Hot dipped galvanized steel masonry single and multi-gang boxes, 89mm (3½") deep, for devices flush mounted in block walls.

.2 Provide 64mm (2½") deep boxes only when wall thickness does not allow 89mm (3½") box to be used.

2.4 CONDUIT BOXES

.1 Cast feraloy boxes, 64mm (2½") deep, with factory threaded hubs and mounting feet for surface mounting of wiring devices and for use in electrical or mechanical rooms and service spaces/corridors.

.2 Provide 43mm (1 11/16") deep boxes only when installation does not allow 64mm (2½") boxes to be used.

.3 Not approved for telecommunications use.

2.5 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Install all outlets flush, plumb and square with building lines.

.2 Support boxes independently of connecting conduits.

.3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of Work.

.4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.6 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.

.7 Installation and minimum box size to be in accordance with Canadian Electrical Code, "Use more than one outlet box where the number of joints exceeds the requirements for the boxes specified.

.8 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.9 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.10 Provide correct size of openings in boxes for conduit and cable connections. Reducing washers are not allowed.

.11 Align outlets that are installed in the same general location so that they are centered.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Provide conduit system as indicated herein, on the drawings and as required.

.2 All home run wiring in the building shall be installed in conduit unless otherwise noted.

1.2 RELATED WORK

.1 Section 26 05 00 - Common Work Results

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
- .2 CAN/CSA C22.2 No. 45, Rigid Metal Conduit.
- .3 CAN/CSA C22.2 No. 56, Flexible Metal Conduit and Liquid Tight Flexible Metal Conduit.
- .4 CAN/CSA C22.2 No. 83, Electrical Metallic Tubing.
- .5 CAN/CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.4 PRODUCT DATA

.1 Submit product data for non-metallic raceways in accordance with Section 26 05 00 Common Work Results - Electrical.

1.5 LOCATION OF CONDUIT

.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

Part 2 Products

2.1 CONDUIT - GENERAL

.1 Minimum conduit size shall be ¾” (21mm) unless otherwise indicated.

2.2 RIGID STEEL CONDUIT

- .1 Galvanized with threaded joints and connections.
- .2 Connections in dry locations: steel or malleable iron lock nuts inside and outside enclosures.
- .3 Connectors subject to moisture: Liquid and dust tight with insulated throat.
- .4 Fittings: steel
- .5 Do not use process piping in lieu of CSA approved conduit.

2.3 EMT CONDUIT

.1 Conduit: electrical metallic tubing with wall thickness less than rigid conduit, hot dipped galvanized with corrosion resistant and friction reducing coating on inside, to CAN/CSA C22.2 No. 83.

.2 Fittings: steel or malleable iron, liquid tight, compression-type, with insulated throat or non-metallic bushings, this is typical for all exterior connections.

2.4 RIGID METAL CONDUIT

.1 Conduit: rigid galvanized steel, heavy wall, with threaded joints and connections to CAN/CSA C22.2 No. 45.

.2 Connectors: liquid and dust tight with insulated throat.

.3 Rigid conduit fittings: outlet boxes, junction boxes, LB's and other fittings cast metal with factory applied epoxy paint.

.4 Expansion joints: rigid conduit type with external bonding jumper.

.5 Ground bushing: threaded type with insulated throat.

2.5 RIGID PVC CONDUIT

.1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride to CAN/CSA C22.2 No. 211.1.

.2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied and recommended by conduit manufacturer.

.3 Fire rating: FT4.

.4 Expansion joints: as supplied and recommended by conduit manufacturer, complete with two O-rings.

2.6 FLEXIBLE CONDUIT

.1 flexible metal conduit, spirally wound, interlocked zinc coated steel strip which may be easily bent without use of tools to CAN/CSA C22.2 No. 56.

.2 Connectors: slip-proof insulated throat or non-metallic bushings, steel type.

2.7 LIQUID TIGHT FLEXIBLE CONDUIT

.1 Conduit: construction same as flexible conduit, with liquid-tight PVC outer jacket to CAN/CSA C22.2 No. 56.

.2 Connector: type providing seal to conduit jacket and positive ground to interior of conduit, with high pull-out resistance and insulated throat, straight or angles.

2.8 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 32mm and smaller. Two hole steel straps for conduits larger than 32mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 U-channel type supports for two or more conduits at no more than 2m o.c. spaced as per code and manufacturer's recommendations, whichever is closer.

.4 Threaded rods, 6mm diameter, to support suspended channels.

.5 Perforated metal and field fabricated hangers and supports not acceptable.

2.9 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90º bends are required for 27mm and larger conduits.

.3 Steel set screw connectors and couplings are not permitted.

.4 Rain-tight connector fittings and couplings complete with O-rings for use on all enclosures and conduit installations, etc.

2.10 EXPANSION FITTINGS FOR RIGID METAL AND PVC CONDUIT

.1 Weatherproof expansion fittings suitable for 200mm linear expansion.

.2 Watertight expansion fittings suitable for linear expansion and 19mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to exterior enclosures/panels.

.4 With internal bonding assembly for metallic conduits.

2.11 FISH CORD

.1 Polypropylene, minimum 200 kg strength, UV resistant.

2.12 EXECUTION

2.13 INSTALLATION GENERAL

.1 Refer to 26 05 00 for identification of conduit systems.

.2 Use electrical metallic tubing (EMT) above 2.4m and in areas where it will not be subjected to physical damage.

.3 All raceways installed outdoors shall be hot dipped rigid galvanized steel with threaded fittings.

.4 Rigid galvanized steel conduit shall be used where exposed to damage, in wet or hazardous locations or under floor slabs and where shown on the drawings.

.5 Use Rigid PVC Conduit in poured concrete, in duct banks, in areas subject to intermittent or continuous moisture. These areas may not necessarily be shown on the drawings.

.6 Use flexible metal conduit in dry locations for connection to motors movable partitions not served by a solid (wiremold type) raceway, fluorescent fixtures recessed in T-bar ceilings, suspended fixtures, transformers and equipment subject to movement or vibration, A Motor connections and connections to transformers in damp locations to be liquid-tight.

.7 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.8 Do not recess conduit in columns or concrete slabs.

.9 Wiring homeruns to panel boards and main branch circuit wiring runs in ceiling space to be run using TECK or in conduit.

.10 Armour of TECK cable shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate at the load end of the cable.

.11 Where conduit is run exposed, run parallel to building lines. Where conduits are grouped (two or more), space evenly, make bends concentric and mount on racks.

.12 Lay out conduit to avoid interference with other Work. Maintain a minimum clearance of 150mm from steam or hot water piping, etc.

.13 Watertight fittings shall be installed in areas exposed to moisture and concrete type fittings in concrete slabs.

.14 Where conduit is required to be bent, do not heat and do not bend in such a way as to reduce the cross-sectional area at any point.

.15 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter. Radius of bend shall be not less than 600mm. Mechanically bend steel conduit over 21mm diameter.

.16 For all runs of conduit, do not include more than the equivalent of four 90-degree bends, including bends located immediately adjacent to an outlet box or fitting. Provide pulling elbows, pull boxes and/or junction boxes where necessary.

.17 Conduits shall be supported within 300mm of entering any junction box, pull box, cabinet or panel board.

.18 Where possible, install conduits so that they are not trapped. Cap turned up conduits to prevent the entrance of any dirt or moisture during construction. If necessary, swab out conduit and thoroughly clean internally before wires and cables are pulled.

.19 Ream conduit ends to remove all burrs. Take extreme care in reaming ends of all conduit to ensure a smooth, interior finish that will not damage the insulation of the wires.

.20 Use insulated non-metallic bushings on all conduit terminators. Ensure electrical continuity in all conduit systems. All conduits shown exposed in finished areas are to be free of labels and trade marks. Install a 45kg test line in all empty conduits. Conduits and ducts crossing building expansion joints shall have conduit expansion fittings to suit the type of conduit used. Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with approved sealing compound.

.21 Touch up damage to epoxy finish on rigid conduit fittings with touch-up paint supplied by manufacturer. Paint exposed threads on rigid conduit with epoxy paint.

.22 Installation of conduits in cast-in-place slabs on grade is acceptable for feeding free-standing equipment only. Installation of conduits in cast-in-place slabs on grade shall not be permitted for any other application.

.23 Conduit to be sized as per Canadian Electrical Code. Note that the sizes of branch circuit conductors scheduled and/or specified on the drawings are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with Canadian Electrical Code. Where conductor sizes are increased to suit voltage drop requirements, increase the conduit size to suit at no extra cost.

.24 Install expansion joints where conduits cross building expansion joints or for outdoor installations.

2.14 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 within 300mm of flues. steam or hot water lines.

.7 When a conduit can be run surface, it shall be primed and painted with two coats to match the wall.

2.15 CONDUITS IN CAST IN PLACE CONCRETE

.1 Installation of conduits in concrete floor slabs is acceptable for feeding free-standing equipment only. Installation of conduits in concrete floor slabs shall not be permitted for any other application.

.2 Obtain approval from Contract Administrator:

.1 Where conduits are spaced closer than 3 diameters.

.2 For conduits greater than 53mm diameter.

.3 Where conduits must be run less than 8 diameters from columns.

.3 Locate to suit reinforcing steel. Install in centre one third of slab. Do not strap directly to parallel reinforcing steel (and reduce concrete bond). Strap to reinforcing steel perpendicular to conduit.

.4 Protect conduits from damage where they stub out of concrete.

.5 Install sleeves where conduits pass through slab or wall.

.6 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.7 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.8 Encase conduits completely in concrete with minimum 50mm concrete cover.

.9 Organize conduits in slab to minimize crossovers.

2.16 GROUNDING

.1 Where current carrying conductors are installed in raceway, provide ground wire of equal size.

.2 Where non-current carrying/telecommunication conductors are installed minimum ground wire size #6 AWG.

.3 Ensure raceways are large enough to accommodate additional (ground) wire.

2.17 LIQUID TIGHT FLEXIBLE CONDUIT

.1 Flexible Conduit shall be used for line and low voltage circuit connections to all motors or equipment subject to vibration and shall be metal PVC coated watertight. Connectors shall be approved for flexible liquid tight conduits.

.2 Provide a separate ground conductor within flexible conduit, bonded to motor frames and system ground.

.3 Install conduit to prevent liquids draining to connectors.

2.18 RIGID PVC CONDUIT

.1 When not encased in concrete:

.1 Provide expansion joints and follow manufacturer’s recommendations and code requirements with respect to expansion/contraction, particularly where temperature variations are anticipated.

.2 Install conduits loosely with straps and clamps to allow movement.

2.19 SLEEVES AND CHASES

.1 Sleeves shall be provided and set for conduit passing through foundations, concrete walls and floors. Sleeves shall have sufficient diameter to allow free conduit movement resulting from thermal expansion and contraction. Sleeves installed through foundation walls, beams and footings shall be installed flush with walls, partitions, floors and ceilings. All sleeves installed below grade shall be caulked with oakum and lead on both sides of

the wall. Sleeves in floors where water is present shall be caulked, graphite packing, and waterproof sealant used.

.2 Where used, sleeves shall be c/w proper connectors and plastic bushing (this is particularly important for telecommunications cabling installation.)

.3 Exact locations of conduit stub ups for connection to service equipment, signs etc., shall be checked and verified with the Contract Administrator. Shop drawings shall be issued prior to rough-in and slab being poured.

.4 No extra claim will be accepted by the Contract Administrator for stub up adjustments as a result of the Electrical Subcontractor not following the checking procedure as described under item 2.

.5 Adjustments of stub ups shall be carried out to the satisfaction of the Contract Administrator. Damaged surfaces shall be repaired to their original condition. Conduit extension shall comply with Canadian Electrical Code and wires are to be re-pulled.

2.20 EMPTY CONDUITS

.1 All empty conduits shall be c/w pull wires.

.2 All conduits stubbed out shall be provided with rubber grommets and end caps.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.1 No.126.1-17, Metal Cable Tray Systems.

.2 CAN/CSA C22.1 No.126.2-02, Non Metallic Cable Tray Systems.

.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

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA VE 1-2017, Metal Cable Tray Systems.

.2 NEMA VE 2-2024, Cable Tray Installation Guidelines.

.4 EEMAC F5-1 – Cabletrough Systems and Accessories.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.4 Identify types of cable trays used.

.5 Show actual cable tray installation details and suspension system.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturers:

.1 Pursley

.2 Thomas & Betts Canstrut series.

.3 Cooper B-Line series.

.4 MP Husky

.5 Or approved equal

2.2 CABLE TRAY

.1 Cable tray and fittings: to NEMA VE 1 and CAN/CSA C22.1 No. 126.1.

.2 Trays: Ladder with 300mm rung spacing, aluminum, 152mm wide with depth of 101 mm.

.3 Load rating of 75kg/m with a 2.4m (8') support spacing

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable tray supplied.

.1 Radii on fittings: 610 mm minimum.

.5 Barriers where different voltage systems are in same cable tray.

.6 Ground cable trays with #2 AWG insulated green copper conductor attached to each tray section in accordance with CEC requirements.

.7 Fire stop system at penetrations.

2.3 SUPPORTS

.1 Provide splices for a continuously grounded system as required.

.2 Support as per NEMA VE 2 to achieve required load ratings.

2.4 BONDING

.1 Provide green insulated copper bonding wire throughout length of cable tray. Fasten ground cable on the outside of tray. Size conductor in accordance with CEC.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cable tray system in accordance with NEMA VE 2.

.2 All cable tray installations shall be installed in accordance with manufacturer's requirements and the requirements of the current version of the Canadian Electrical Code.

.3 Provide barriers between different system voltages.

.4 Maintain fire separations with approved products.

.5 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Lay cables into cable tray. Use rollers when necessary to pull cables.

.3 Secure cables in cable tray at 6m centres, with nylon ties.

.4 Identify cables every 30m with size 2 nameplates in accordance with Section 26 05 00.

3.3 GROUNDING

.1 Bond cable tray at 3m centres, using approved ground clamps.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.1 Electrical Equipment Manufacturers Association of Canada (EEMAC)

.2 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.

.3 CSA C22.2 No. 254:21, Motor control centres (Trinational standard with UL 845 and NMX-J-353-ANCE-2012)

.3 City of Winnipeg (Latest Issued Editions)

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

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

.3 Identification Standard

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for motor control centres and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

.2 Indicate on drawings:

.1 Outline dimensions.

.2 Configuration of identified compartments.

.3 Floor anchoring method and dimensioned foundation template.

.4 Cable entry and exit locations.

.5 Dimensioned position and size of busbars and details of provision for future extension.

.6 Schematic and wiring diagrams.

.7 Network diagram showing interconnection of components

.8 Weight

.9 Front view, top view, and rear view (if back-to-back), complete with dimensions.

.10 Bill of materials listing contents of each bucket including but not limited to starters, breakers, and major components. Include quantity, product type, description, part number, and voltage and current ratings.

.11 Lamacoid schedule

.4 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.4 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for motor control centre for incorporation into manual.

.1 Include data for each type and style of starter.

.2 Wiring diagram of each compartment complete with clearly labeled terminals

.3 Torquing requirements

1.5 EXTRA STOCK MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00, Closeout Submittals.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with 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 off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect motor control centres from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPLY CHARACTERISTICS

.1 MCC-B7001: 600 VAC, 600A, 60 Hz, Wye connected, 3 Phase, 3 Wire (or as indicated on drawings).

.2 MCC-B7002: 600 VAC, 600A, 60 Hz, Wye connected, 3 Phase, 3 Wire (or as indicated on drawings).

2.2 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

.2 Floor mounting, free standing, enclosed dead front.

.3 Indoor CSA gasketed enclosure.

.4 Suitability for Service Entrance: No.

.5 Wiring class: Class 1, Type B-D or B-T as shown on the drawings.

.6 Compartment Nameplates:

.1 White background with black letters.

.2 Identification as indicated on the Drawings.

.7 Nameplates for Control Equipment Flush Mounted on Compartments:

.1 White background with black letters. Black background with white text will not be accepted.

.2 Identification as indicated on the Drawings.

.3 Locations as shown on the Drawings

.8 SCCR: 18 kA minimum.

.9 Acceptable manufacturer:

.1 Schneider Electric (Square D) Model 6

.2 Eaton

2.3 VERTICAL SECTION CONSTRUCTION

.1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.2 Each vertical section divided into compartment units, height as indicated.

.3 Each unit to have complete top and bottom steel plate for isolation between units.

.4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.

.6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.

.7 Incoming cables to enter at top.

.8 Provision for outgoing cables to exit via top or side with terminals.

.9 Removable lifting means.

.10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.

.11 Divide assembly for shipment to site, as indicated complete with hardware and instructions for re-assembly.

.12 Provide all spaces complete with bussing hardware and other accessories required so that additional combination starter units can be readily installed. Provide barriers to isolate the space from all buswork.

.13 Provide barriers to isolate all buswork to prevent accidental contact when starter units are removed or spaces are provided. Barriers shall also provide phase-to-phase isolation of the vertical bus.

.14 Master nameplate lamacoid: text as follows:

.1 Line 1 is to be MCC identifier as indicated on the Drawings, for example: “MCC-B7001”.

.2 Line 2 is to be the rating, for example “600V, 3P 600A, 3W”.

.3 Line 3 is to be the feeding equipment, for example “Fed by Digesters MCC”

.4 Provide bolted steel cover plate for rear enclosure panels. All components of single-sided MCC to be accessible from the front.

2.4 SILLS

.1 Continuous channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 BUSBARS

.1 Main horizontal and branch vertical, three phase and neutral high conductivity plated copper busbars in separate compartment bare self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:

.1 Main horizontal busbars: as indicated.

.2 Branch vertical busbars: as indicated.

.2 Branch vertical busbars for distribution of power to units in vertical sections.

.3 No other cables, wires, equipment in main and branch busbar compartments.

.4 Brace buswork to withstand effects of short-circuit current.

.5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.6 GROUND BUS

.1 Copper ground bus extending entire width of motor control centre.

.1 Size: 6 x 25 mm (1/4” x 1”)

.2 Plating: Tin

.3 Location: Top

.2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

.1 Material: tin plated copper.

.3 All hinged doors to be bonded to the ground bus by flexible copper straps.

2.7 TRANSIENT VOLTAGE SURGE SUPPRESSOR/SURGE PROTECTION DEVICE

.1 Supply and install a Transient Voltage Surge Suppressor (TVSS) where shown on the drawings.

.2 Requirements:

.1 TVSS units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449).

.2 Voltage: Refer to drawings.

.3 Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 115% of the nominal system operating voltage.

.4 The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

.5 Protection Modes – The TVSS must protect all modes of the electrical system being utilized. The required protection modes are:

.1 3Ø, 3W System: L-L, and L-G

.2 1Ø, 3W Wye System: L-L, L-N, L-G, and N-G

.6 Nominal Discharge Current (In) – All TVSSs applied to the distribution system shall have a 20kA In rating regardless of their TVSS Type (includes Types 1 and 2) or operating voltage. TVSSs having an In less than 20kA shall be rejected.

.7 ANSI/UL 1449 Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 VPR for the device shall not exceed the following:

.1 L-N, L-G, N-G:

.1 120/208 V: 700V

.2 600 V: 1500V

.2 L-L:

.1 120/208 V: 1200V

.8 TVSS Design

.1 Maintenance Free Design – The TVSS shall be maintenance free and shall not require any user intervention throughout its life. TVSSs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. TVSSs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. TVSSs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

.2 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable TVSS modules shall not be accepted.

.3 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method.

.4 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall utilize low impedance conductors.

.5 Monitoring Diagnostics – Each TVSS shall provide the following integral monitoring options:

.1 Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of each protection mode on each phase.

.6 The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

.7 Overcurrent Protection

.1 The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-

safe manner should a condition occur that would cause them to enter a thermal runaway condition.

.8 Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

.1 600V Equipment – Service Entrance: 240 kA

.2 600V Equipment – Not Service Entrance: 120 kA

.9 Installation Requirements:

.1 The TVSS shall be installed immediately following the load side of the main breaker or main switch.

.2 The MCC shall be capable of re-energizing upon removal of the TVSS.

.3 Utilize a breaker, appropriately rated as directed by the TVSS manufacturer, to connect the TVSS to the MCC. The TVSS shall be located directly adjacent to the circuit breaker.

.4 The TVSS shall be included and mounted within the MCC by the manufacturer of the MCC where shown on the drawings.

.1 The complete MCC including the TVSS shall be CSA/cUL listed.

2.8 POWER METER (MCC-B7001.PM, MCC-7002.PM)

.1 Where indicated on the drawings, provide a microprocessor based multifunction power meter.

.2 Requirements:

.1 Multifunction electrical measurement on 3 phase power systems.

.2 User programmable for voltage range to any PT ratio.

.3 Integrated display.

.4 Accept a direct voltage input range of up to 347 Volts Line to Neutral, and a range of up to 600 Volts Line to Line.

.5 Accept a current input of up to 5 Amps nominal, 10 Amps full scale.

.6 Programmable for current to any CT ratio. The use of DIP switches for selecting

.7 fixed ratios shall not be acceptable.

.8 Maximum burden of 0.0625 VA at 10 Amps.

.9 The meter shall have an accuracy of +/- 0.25% or better for volts and amps, and

.10 1.5% for power and energy functions.

.11 The meter shall provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.

.12 Function Requirements:

.1 Volts, Amps, kW, kVAR, PF, kVA (per phase)

.2 Frequency, kWh, kVAh, kVARh

.3 Harmonics measurement, individual, even, and odd, up to 15th.

.13 Operating Temperature:

.1 -20°C to +60°C ambient.

.3 Communications ports:

.1 RS-485 supporting Modbus/RTU.

.2 10 Mbps or 10/100 Mbps Ethernet supporting Modbus/TCP.

.4 Acceptable Products:

.1 Schneider Electric PM8000 series.

.2 Or approved equal in accordance with B8

2.9 VOLTAGE MONITORING RELAY (ESL-B70012, ESL-B70022)

.1 Requirements,

.1 Suitable for direct connection to MCC bus having nominal operating voltage of 600 V line-to-line.

.2 Adjustable nominal input voltage via potentiometer from 500 V to 600V.

.3 Undervoltage trip point:

.1 Adjustable from 88% to 92% of nominal voltage.

.2 Voltage unbalance:

.1 Adjustable from 2% to 10%.

.3 Phase loss detection:

.1 Triggered upon ≥ 15% unbalance.

.2 Response time ≤ 200 msec.

.4 Trip delay:

.1 Adjustable from 1 to 30 sec.

.5 Automatic reset (restart) delay:

.1 Adjustable from 0.6 to 64 sec.

.2 Adjustable random restart delay from 3 to 15 sec.

.6 Faults stored in non-volatile memory.

.1 Storage of the last 10 faults.

.7 Status and faults displayed on LED readout.

.8 Remote reset input.

.9 CSA approved.

.4 Relay output:

.1 Equipped with, at minimum, one Form C electromechanical dry contact output for monitoring.

.2 Relay contact to be normally open, held-closed during normal operation, and open upon an alarm condition.

.3 Actuate relay on any of the following:

.1 Phase A-B, B-C, or C-A voltage less than 575 V.

.2 Voltage unbalance greater than 10%.

.4 Rated at 10A resistive @ 250 VAC, 6A inductive (0.4 PF) @ 250 VAC.

.5 Mechanical life of 1x107 operations.

.5 Acceptable products:

.1 Littlefuse DLMHBRAAA.

.2 Or approved equal in accordance with B8.

2.10 MOTOR STARTERS AND DEVICES

.1 Equip the MCC with combination starters as specified and shown on the drawings.

.2 Refer to Section 26 29 10 – Motor Starters to 600 V.

2.11 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.

.2 Unit mounting:

.1 Engaged position - unit stabbed into vertical bus.

.2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.

.3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

.4 Stab-on connectors free-floating tin-plated clips, self-aligning, backed up with steel springs.

.3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3padlocks to lock operating handle in "off" position and lock door closed.

.4 Hinge unit doors on same side.

.5 Overload relays manually reset from front with door closed.

.6 Pushbuttons and indicating lights mounted on door front.

.7 Devices and components by one manufacturer to facilitate maintenance.

.8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

.9 Control wiring shall be extended from each starter module to the control terminal section, including all auxiliary contacts. A multi unit style terminal block having screw type terminal connections shall be installed on standoff supports on back plate.

.10 All terminals shall be number coded or otherwise suitably identified to indicate which section or module of the MCC they are associated with and their function.

.11 Complete control wiring diagrams for each starter with conductor identification clearly shown shall be affixed to the interior cover of the starter section or provide a book of wiring diagrams for all starters in each MCC.

.12 Primary and secondary high rupturing capacity (HRC) fusing shall be installed on the control transformer.

.13 Equip door of each individual unit with a removable plate replaceable with similar plate complete with pushbuttons, pilot lights or selector switches as required. Use pilot lights of push-to-test type and push button of heavy-duty oil tight construction.

2.12 WIRING IDENTIFICATION

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

2.13 EQUIPMENT IDENTIFICATION

.1 Identify Motor Control Centre with nameplates as follows:

.2 Nameplates:

.1 Lamacoid 3 mm thick plastic lamacoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

2.14 NAMEPLATE SIZES

.1 Motor control centre main nameplate 70 x 120 mm 1 line 40 mm high letters

.2 Individual compartment nameplates 30 x 90 mm 3 lines 5 mm high letters

.3 Compartment Device namplates 30 x 25 mm 2 lines 3 mm high letters

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

.3 Allow for average of twenty-five (25) letters per nameplate.

.4 Identification to be English.

.5 Additional requirements as indicated in 26 05 00.

2.15 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 exterior light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Paint interior white, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during construction.

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

2.16 SOURCE QUALITY CONTROL

.1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

.2 Contract Administrator to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls. Notification of witness testing to be provided a minimum of 21 days prior to testing date.

2.17 SPARE PARTS

.1 One (1) set of fuses of each type and size.

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 motor control centres 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 INSTALLATION

.1 Provide housekeeping pad below the MCC lineups as per the drawings.

.2 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.3 Make field power and control connections as indicated.

.4 Ensure correct overload heater elements are installed.

.5 Coordinate concrete pad with bevelled edges as shown on the Drawings, sized to suit MCCs, install and level channel sills and mount MCCs.

3.3 TESTING

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results – For Electrical.

.2 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full.

.3 Provide separate completed test forms for each MCC starter section.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate starters in sequence to prove satisfactory performance of motor control centre during 8 hours period.

3.5 CLEANING

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers, and ground-fault circuit-interrupters.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489 and the NMX-J-266-ANCE).

1.4 SUBMITTALS

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

.2 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 25 kA symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers and ground-fault circuit-interrupters: to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as indicated on drawings.

2.2 THERMAL MAGNETIC BREAKERS

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

2.3 OPTIONAL FEATURES

.1 Include:

.1 On-off locking device.

.2 Handle mechanism.

2.4 MANUFACTURERS

.1 Acceptable manufacturers:

.1 New breakers installed in existing equipment to be of same manufacturer as the equipment in which they are installed.

.2 Breakers installed within new motor control centres to match motor control centre manufacturer.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated on drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.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.14-18, Industrial Control Equipment.

.2 City of Winnipeg

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

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2022, Industrial Control and Systems: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for control devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

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

.2 Include schematic, wiring, interconnection diagrams.

1.4 QUALITY ASSURANCE

.1 Conduct tests in accordance with Section 26 05 00- Common Work Results for Electrical.

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 control devices for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with 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, off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect control devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to NEMA ICS 1 CSA C22.2 No.14.

.2 Convertible contact type: contacts field convertible from NO to NC, permanent magnet latched electrically held, double-voltage type with sliding barrier to permit access to contacts only or coil only, with pneumatic, solid state timer. Coil rating: overlap type.

2.2 RELAY ACCESSORIES

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

2.3 PUSHBUTTONS

.1 Operator mushroom type. Black, with 1-NO and 1-NC, labels as indicated. Stop pushbuttons coloured red, labelled "Stop".

2.4 SELECTOR SWITCHES

.1 Standard maintained 2 position or 3 position as indicated on drawings.

.2 Labelled as indicated on drawings.

2.5 INDICATING LIGHTS

.1 Standard, full voltage, type, lens colour: as indicated, supply voltage: as indicated, lamp voltage: labels as indicated.

.2 Labelled as indicated on drawings.

2.6 EMERGENCY STOP PUSHBUTTONS

.1 Supply and install enclosed two-position maintained emergency stop operator stations as indicated on drawings.

.2 Provide emergency stop boxes for mounting of switches for all field located emergency stops.

.3 Requirements:

.1	Type:	Push-Pull / Twist to release
.2	Ingress Protection:	NEMA 4X
.3	Contact Life:	1,000,000 cycles
.4	Mechanical Life:	250,000 cycles
.5	Contact Rating:	10 A
.6	Contact Configuration:	As shown on the drawings
.7	Illumination:	Not required unless otherwise indicated.

.4 Acceptable Products:

.1 Schneider Electric Harmony 9001 K Series,

.2 Allen-Bradley 800H series,

.3 Or approved equal in accordance with B8.

2.7 CONTROL AND RELAY PANELS

.1 CSA Type 4 sheet steel enclosure with hinged padlock able access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.8 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 600V, 60 Hz ac.

.3 Secondary: 120 V, AC. (or as indicated on drawings)

.4 Rating: 50VA. (or as indicated on drawings)

.5 Secondary fuse: 3A. (or as indicated on drawings)

.6 Close voltage regulation as required by magnet coils and solenoid valves.

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 control devices 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 INSTALLATION

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

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

3.4 CLEANING

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

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

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 CSA C22.2 No.14-18, Industrial Control Equipment.

.1 City of Winnipeg

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

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2022, Industrial Control and Systems: General Requirements.

.2 NEMA ICS 2-2000 (R2020), Controllers, Contactors and Overload Relays Rated 600 V.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout of identified internal and front panel components.

.4 Enclosure types.

.5 Wiring diagram for each type of starter.

.6 Interconnection diagrams.

1.4 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 26 05 00 Common Work Results - Electrical.

.2 Include operation and maintenance data for each type and style of starter.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 26 05 00 Common Work Results - Electrical.

1.6 EXTRA MATERIALS

.1 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.

.2 3 contacts, movable.

.3 1 contacts, auxiliary.

.4 1 control transformer.
.5 1 operating coil.
.6 3 fuses.
.7 10% indicating lamp bulbs used.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 MATERIALS

.1 Starters: to NEMA ICS 2-2000

2.2 FULL VOLTAGE MAGNETIC STARTERS

.1 UL/CSA listed, NEMA size as shown on the drawings.

.1 Smallest size of starter: NEMA size 1, unless otherwise indicated

.2 IEC rated starters are not acceptable.

.2 Short Circuit Current Rating (SCCR):

.1 The Short Circuit Current Rating (SSCR) of the assembly must equal or exceed the rating of the MCC or panel it is fed from.

.3 Magnetic of size, type, rating and enclosure type as indicated with components as follows:

.1 All coils to be epoxy coated.
.2 Contactor solenoid operated, rapid action type.
.3 Motor overload protective device in each phase, manually reset from outside enclosure.
.4 Power and control terminals
.5 Wiring and schematic diagram inside starter enclosure in visible location.
.6 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
.7 Transient suppressors shall be supplied for all coils in each individual starter unit.

2.3 FULL VOLTAGE REVERSING STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.
.2 Thermal motor overload protective relay.

.1 Acceptable manufacturers:

.1 Schneider Electric

.2 Eaton

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include motor circuit interrupter.

.3 Accessories:

.1 Pushbuttons and selector switches: heavy duty oil tight labelled as indicated.

.2 Indicating lights: heavy duty oil tight type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity. At minimum, transformer to have a capacity of 50VA greater than the required draw of its bucket components.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00, Common Work Results - Electrical.

2.6 EQUIPMENT IDENTIFICATION

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

.2 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

2.7 MANUFACTURERS

.1 Acceptable MCC mounted starter manufacturer: to match MCC manufacturer

.2 Starters supplied as part of the boiler vendor package: GE, Allen Bradley, Eaton (Cutler Hammer) or Schneider (Square D).

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload device elements installed.

3.2 MOTOR STARTER TESTING

.1 Perform tests in accordance with Section 26 05 00, Common Work Results – For Electrical.

.2 Perform complete testing of motor starter operation, including but not limited to:

.1 Simulating a soft starter module fault to ensure the starter can be reset and put back into operation.

.2 Manual startup and shutdown.

.3 Automatic startup and shutdown.

.3 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full. Submit test results to the Contract Administrator.

.4 Contract Administrator and/or City of Winnipeg will be required to witness motor starter testing in person. Provide a minimum of two (2) weeks notice prior to performing testing of motor starters.

.5 Provide separate completed test forms for each starter.

3.3 OVERLOAD RELAYS

.1 For starters provided, select overload relays in accordance with relay and motor manufacturers' recommendations, considering motor service factors, ambient temperature, temperature differences between motor and starter locations. Monitor motor operation during start-up to ensure motor operation is satisfactory and relays provide proper protection. For side inlet and other long acceleration time motors, provide special overload relays to suit the start-up condition. Provide manufacturers' curves and data sheets where necessary to provide supporting data for motor protection and to perform a co-ordination study.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00, Common Work Results - Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Technical requirements related to the design and supply of Variable Frequency Drives (VFD), including all equipment, manufacture, assembly, factor, wiring, inspection, testing and delivery.

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results

1.2 REFERENCE STANDARDS

.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 City of Winnipeg

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

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

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

.3 NEMA, National Electrical Manufacturer Association

.4 IEEE, The Institute of Electrical and Electronics Engineers

.5 Other, Local Power Utility and Telephone Utility Guidelines for Harmonic Distortion.

1.3 DESIGN REQUIREMENTS

.1 Provide equipment layout drawing detailing:

.1 The dimensions, physical arrangement of major components, and the degree of compartmentalization and physical segregation provided between components.

.2 Front layout of the panel.

.3 When air-cooled systems are provided, the following shall also be shown:

.1 Air inlet and outlet passages

.2 Cooling fans

.3 Filters

1.4 SUBMITTALS

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

.2 Submit shop drawings including:

.1 Panel layout.

.2 Wiring diagrams:

.1 AutoCAD versions of the VFD schematic drawings will be provided upon request.

1.5 PARTS AVAILABILITY

.1 Guarantee that parts for the drive units be available for a minimum of ten years from time of delivery.

1.6 DESIGN REQUIREMENTS

.1 Ventilation system designed for ambient temperature range of 10°C to 35°C, temperature not to exceed 25°C.

Part 2 Products

2.1 VARIABLE FREQUENCY DRIVES

.1 Variable speed controller shall be electronic adjustable frequency and voltage output unit.

.2 Designed to operate standard squirrel cage induction motor with a 1.15 S.F. or definite purpose motors meeting NEMA MG1 Part 31.

.3 Harmonic loading will not exceed a motor service factor of 1.0.

.4 Products shall comply with IEEE standard 519.

.5 CSA certified.

.6 The VFD shall employ a minimum of 6-pulse pulse width modulated (PWM) system utilizing insulated Gate Bipolar Transistors (IGBT) power switching device and come complete with line and load reactors.

.7 Be capable of re-accelerating the driven equipment, following voltage dips greater than 20% of the rated input power supply, of up to 5 seconds duration, without the need to come to a complete stop. Vendor shall indicate the maximum time delay before re-acceleration begins following restoration of the supply voltage.

.8 Be capable to continue operation without coming to a standstill or resulting in process shutdown, following any momentary voltage dips in the input power supply, auxiliary power supply, or both, of less than 20% rated voltage, which last for less than 0.5 second.

.9 Designed to provide output requirements dictated by the speed/torque characteristics of motor and driven equipment over the entire speed range. The motors may be supplied by others.

.10 VFD shall convert the line input power to adjustable AC voltage and frequency output power. The output power shall be controlled such that permissible volts/Hertz ratio is not exceeded throughout the specified operating speed range, over a voltage range of ±10% and frequency variation of ± 5%.

.11 The VFD output frequency shall not deviate more than ± 1% of any given set point within the operating frequency range.

.12 The VFD shall be provided with radio interference suppression and limit radio interference values to within the limits of local code requirements.

.13 Input Run Command signals will be a 24Vdc discrete signal.

.14 Input frequency setting signal will be 0-10 VDC and 4-20 mA.

.15 Output speed and current monitoring signals will be 4-20 mA.

.16 Enclosure:

.1 VFD shall be installed within the MCC.

.2 Filters to be provided for any forced air-cooled enclosures as required by the supplier. VFD(s) shall be suitable for the location installed and shall be able to operate under these conditions with no special cleaning requirements.

.17 Operational features:

.1 Integral flush mounted keypad on enclosure door for programming, monitoring, and operating the drive, accessible through password or other acceptable security measure only.

.2 Integral selector switches and pushbuttons, where shown on the drawings:

.1 Heavy duty, oil-tight, 30mm.

.18 Diagnostic features:

.1 Integral long life LED indicating lights on enclosure door as indicated on drawings.

.19 As supplied by one of the following acceptable manufacturers:

.1 Schneider Electric and Eaton

2.2 TERMINALS

.1 Terminals as follows (or as indicated on drawings):

.1 Feed-through: Phoenix Contact 3046184 or approved equal in accordance with B7,

.2 Potential earth: Phoenix Contact 3046207 or approved equal in accordance with B7,

.3 Fused: Phoenix Contact 3046142 with 3036806 or approved equal in accordance with B7,

.4 End plate: Phoenix Contact 3047141 or approved equal in accordance with B7

.5 RJ-485 port for Modbus/TCP communication to NEWPCC PCS.

.6 Any and all other terminals required to make a fully functional system as indicated on the drawings.

2.3 COOLING SYSTEM

.1 Perform heat load analysis to determine air-cooling requirements.

.2 Air-cooled converters shall meet the following:

.1 Redundant cooling fans

.2 Cooling fan operates when pump is started from VFD or bypass system or when enclosure reaches hi temperature.

.3 Provide adjustable hi temperature switch, with minimum range 10°C to 30°C.

2.4 WIRING

.1 Utilize the following wire colours for the types of voltage/signals indicated:

.1	120VAC Line:	Black
.2	120VAC Control:	Red
.3	120VAC Neutral:	White
.4	24VDC Supply:	Blue
.5	24VDC Control:	Blue
.6	24VDC Common:	Brown

.7	24VAC Supply:	Black
.8	24VAC Control:	Red
.9	24VAC Neutral:	White
.10	10VDC Supply:	Blue
.11	0-10VDC Signal:	Blue
.12	10VDC Common:	Brown
.13	Intrinsically Safe:	Light Blue
.14	4-20mA Signal:	White (+), Black (-)

.2 All conductors shall be securely fastened to terminals at both ends; no splices are allowed inside the panel.

.3 No more than two (2) conductors may be terminated under each terminal screw. 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.

.4 All wires and cables inside the VFD panels shall be identified on both ends with non-erasable markers from.

.5 Identification shall follow the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.6 Individual conductors or wires exiting a cable shall be identified using non-erasable markers.

.7 The routing of all analog, digital, and power cable wiring inside VFD panels shall be segregated as much as possible, in distinct wiring ducts, by the type of signal they are carrying. All wires shall be physically protected by wiring ducts with covers. The wiring ducts shall be of sufficient size to be filled to a maximum of 50% when all wires are inside.

.8 All analog signal wiring shall be 18 AWG shielded twisted pairs such as Belden No. 8760, or an approved equivalent 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 panel wiring shall be 16 AWG TEW stranded conductor.

.1 Increase the size of power wiring, 12 AWG minimum.

.10 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.11 The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door. Each end of the loop shall be properly supported.

2.5 PROGRAMMING AND COMMISSIONING

.1 Electrical subcontractor shall be responsible for programming and commissioning of all variable frequency drives. Contract Administrator shall provide contractor with project specific VFD initial settings to be entered into the drives, all other settings shall be determined by the electrical subcontractor.

.2 Electrical subcontractor shall allow for settings to be adjusted as required during commissioning.

.3 Ethernet Patch Cords

.1 Requirements:

.1 CAT-6.

.2 Jacket colour: Blue.

.4 Wiring Duct

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or an approved equivalent 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.

.4 120 VAC wires cannot share wiring duct with 10 VDC, 24 VDC or 4-20 mA wires, but can cross their path.

2.6 SPARE PARTS

.1 Provide, at minimum, the following spare parts:

.1 One cooling fan.

.2 All control fuses.

.3 One N.O. and N.C. contact block for control switches.

.4 One form “C” relay.

.2 Spare parts to be provided in a sealed plastic bag taped to side of enclosure interior.

Part 3 Execution

3.1 INSTALLATION

.1 VFD cabinets shall be mounted in such a way that there is adequate room for ventilation and no build up of heat. The minimum clearance in front of VFDs is 1 m.

3.2 CONFIGURATION

.1 Submit settings sheet for review.

.2 Configure VFD parameters as specified on settings sheet.

.3 Include settings sheets in the O&M manuals.

3.3 TESTS

.1 VFD units are to be factory tested prior to shipment. Provide confirmation from factory of actual tests completed and results.

.2 Confirm VFD capability to continue operation without coming to a standstill, following any momentary voltage dips in the input power supply, auxiliary power supply or both of less than 20% rated voltage, which last for less than 0.5 seconds.

.3 Confirm VFD capability to automatically re-accelerate following loss of voltage for up to five seconds.

.4 Field testing:

.1 Provide on-site start-up, fine-tuning, commissioning, operator training, and instruction.

.2 Full-load functional test of the VFD shall be performed. The test shall prove the correct operation of all control functions, auxiliaries, protective systems, alarms and metering.

.3 Ensure shaft to ground voltages do not exceed 1.5 V at any speed or load requirement.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK BY CONTRACTOR

.1 The scope of work includes all items identified on the drawings and the specifications. The work shall be performed as per WSTP Automation Design Guide Rev 03. The following list of major Work items has been provided as a high-level overview:

- .1 Perform all required start-up, testing and commissioning of the new boilers BLR-B0005, BLR-B0006, including local HMI, as outlined in Section 23 52 00 Heating Boilers, and Appendix B Commissioning Plan.
- .2 Provide operator training for the new boilers BLR-B0005 and BLR-B0006 as outlined in Section 23 52 00 Heating Boilers.
- .3 Installation of instrumentation and control devices supplied loose with boilers BLR-B0005 AND BLR-B0006.
- .4 Perform required loop checks as indicated in Appendix B Commissioning Plan.
- .5 Perform motor bump tests as indicated in Appendix B Commissioning Plan.
- .6 Provide support during Plant PCS commissioning and testing by the City.

1.2 SCOPE OF WORK BY THE CITY

.1 This section outlines the scope of work that will be completed by the City.

- .1 Plant DCS/PCS PLC programming for modification to existing equipment and addition of new equipment.
- .2 Plant DCS/PCS HMI (S+ SCADA) programming for modification to existing equipment and addition of new equipment.
- .3 Provide operator training for the new modifications to the plant DCS/PCS.

1.3 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results – Electrical for general component Identification and support requirements.

1.4 REFERENCES

.1 City of Winnipeg Standards

- .1 WSTP Automation Design Guide (612620-0013-40ER-0001)
- .2 WWD Identification Standard
- .3 WSTP Tag Naming Standard (612620-0014-40ER-0001)
- .4 Appendix B Commissioning Plan

1.1 DEFINITIONS

.1 PLC: Programmable Logic Controller

.2 DCS: Distributed Control System

.3 LCD: Liquid Crystal Display

.4 LED: Light Emitting Diode

.5 COM: Communications

.6 LAN: Local Area Network

.7 PVC: Poly Vinyl Chloride

.8 CMF: Central Monitoring Facility

1.2 SUBMITTALS

.1 General: Submit items in this Article according to Section 26 05 00 – Common Work Results – Electrical.

.2 Product Data for monitoring and control equipment shall include physical dimensions and data on features, components, ratings, and performance. Include wiring diagram and elevation views of the front display panel/keypad where applicable.

.3 Shop Drawings detailing dimensions, components, location and identification of field connections, arrangement of components and operational characteristics. Include flow report data for flowmeters demonstrating accurate flow over the required range for the specified pipe diameter.

.4 Wiring Diagrams detailing the installation of the equipment and differentiating between factory-installed and field-installed wiring.

1.3 CLOSEOUT SUBMITTALS

.1 Final Report:

.1 Include measurements, final settings and certified test results.

.2 Include completed commissioning forms.

.3 Bear signature of commissioning technician and supervisor.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications as set during commissioning and submit to the Contract Administrator in accordance with Contract Document.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.4 QUALITY ASSURANCE

.1 Electrical Component Standard: Provide components that are listed and labelled by CSA or cUL where applicable.

.2 Listing and Labelling: Provide products specified in this Section that are listed and labelled by an organization that has been accredited by the Standards Council of Canada.

1.5 COMMISSIONING AND PRE-COMMISSIONING FORMS

.1 The commissioning forms are included in Appendix B Commissioning Plan.

.2 Supplement the commissioning forms as required to make a complete commissioning report package.

1.6 COMMISSIONING

.1 Comply with Appendix B Commissioning Plan

.2 Carry out commissioning under direction of the Contract Administrator and in the presence of representatives of the Contract Administrator and the City.

.3 Inform, and obtain approval from the Contract Administrator in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.
.2 Testing/commissioning procedures, anticipated results.
.3 Names of testing/commissioning personnel.
.4 Correct deficiencies and re-test until satisfactory performance is obtained.
.5 Acceptance of tests will not relieve Electrical Subcontractor from responsibility for ensuring that complete systems meet every requirement of Contract.
.6 Perform tests as required.

1.7 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by the Contract Administrator.

1.8 TRAINING FOR EACH SITE

.1 Training shall be provided as per Section 01 79 00 - Demonstration and Training.

1.9 WARRANTY

.1 Warranty Per: Part D – Supplemental Conditions.

Part 2 Products

2.1 GENERAL

.1 All instruments to be CSA or cUL rated.

.2 All instruments to be suitable for the environment in which they are installed. Where conflict exists between these specifications and other contract documents, the most stringent shall apply unless directed otherwise by the contract administrator.

2.2 PRESSURE DIFFERENTIAL FLOW METERS (FIT – B0050, FIT-B0060)

.1 General Requirements

.1 Type: Differential Pressure Flow Meter
.2 Acceptable Manufacturer: Siemens SITRANS FP230 with transmitter (No Alternative as per City's RFP 449-2014)
.3 Measurement Principle: Utilizes the differential pressure created by a primary flow element (e.g., orifice plate) to determine flow rate.
.4 Application: Suitable for measuring the flow of gases.
.5 System Components:
.1 Orifice plate
.2 Integrated Differential pressure sensor

.3 Transmitter

.2 Piping Data

.1 Pipe Material: Stainless Steel
.2 Nominal Diameter: 3 inch
.3 Pressure Rating: CL150
.4 Pipe Schedule: 40S
.5 Orientation: Vertical
.6 Shape: Round
.7 Flow Direction: Lef to Right
.8 Inner Diameter: 3.07 inch
.9 Wall Thickness: .22 Inch

.3 Primary Element

.1 Primary Element Type: Orifice (One piece, carrier ring, corner taps)
.2 Primary Element material: Orifice all parts 1.0404/316L

.4 Process Condition

.1 Fluid Type: Digester Gas
.2 Fluid State: Vapour
.3 Flow:
.1 Normal (Operating): 316 Nm^3/hr
.2 Maximum (Full Scale): 395 Nm^3/hr
.4 Pressure:
.1 Normal (Operating): 117 kPag
.2 Maximum (Full Scale): 207 kPag
.5 Temperature:
.1 Normal (Operating): 25°C
.2 Maximum (Full Scale): 37.5°C
.6 Design Pressure: 207 kPag
.7 Design Temperature: 37.5°C

.5 Materials of Construction

.1 Body: Stainless Steel 316L
.2 Primary Element: Stainless Steel 316LS
.3 Seals: Seals to be compatible with digester gas

.6 Process Connections

.1 Flange Type: ANSI B16.5, Class 150
.2 Connection Size: See P&ID

.7 Transmitter Specifications

.1 Output: 4-20 mA
.2 Power Supply: 12-36 VDC
.3 Display: LCD with backlight
.4 Enclosure: IP67, explosion-proof
.5 Electrical Connection: 4x1/2” NPT

.8 Compliance and Certifications

.1 Certifications: CSA

2.3 PRESSURE DIFFERENTIAL FLOW METERS (FIT-B0052, FIT-B0062)

.1 General Requirements

.1 Type: Differential Pressure Flow Meter

.2 Acceptable Manufacturer: Siemens SITRANS FP230 with transmitter (No Alternative as per City's RFP 449-2014)

.3 Measurement Principle: Utilizes the differential pressure created by a primary flow element (e.g., orifice plate) to determine flow rate.

.4 Application: Suitable for measuring the flow of gases.

.5 System Components:

.1 Orifice plate

.2 Integrated Differential pressure sensor

.3 Transmitter

.2 Piping Data

.1 Pipe Material: Carbon Steel

.2 Nominal Diameter: 3 inch

.3 Pressure Rating: CL150

.4 Pipe Schedule: 40

.5 Orientation: Vertical

.6 Shape: Round

.7 Flow Direction: Lef to Right

.8 Inner Diameter: 3.07 inch

.9 Wall Thickness: .22 Inch

.3 Primary Element

.1 Primary Element Type: Orifice (One piece, carrier ring, corner taps)

.4 Process Condition

.1 Fluid Type: Natural Gas

.2 Fluid State: Vapour

.3 Flow:

.1 Normal (Operating): 190 Nm^3/hr

.2 Maximum (Full Scale): 237 Nm^3/hr

.4 Pressure:

.1 Normal (Operating): 35 kPag

.2 Maximum (Full Scale): 35 kPag

.5 Temperature:

.1 Normal (Operating): 25°C

.2 Maximum (Full Scale): 25°C

.6 Design Pressure: 35 kPag

.7 Design Temperature: 25°C

.5 Materials of Construction

.1 Body: Stainless Steel 316L
.2 Primary Element: Stainless Steel 316LS
.3 Seals: Seals to be compatible with natural gas

.6 Process Connections

.1 Flange Type: ANSI B16.5, Class 150
.2 Connection Size: See P&ID

.7 Transmitter Specifications

.1 Output: 4-20 mA
.2 Power Supply: 12-36 VDC
.3 Display: LCD with backlight
.4 Enclosure: IP67, explosion-proof
.5 Electrical Connection: 4x1/2” NPT

.8 Compliance and Certifications

.1 Certifications: CSA

2.4 MAGNETIC FLOW METERS (FIT-B0051, FIT-B0061)

.1 Requirements

.1 Acceptable Manufacturer: Siemens SITRANS FM MAG51002W with transmitter (No Alternative as per City’s RFP 449-2014)
.2 Measurement Principle: Electromagnetic induction
.3 Application: Suitable for measuring the flow of liquids

.2 Process Condition

.1 Fluid Type: HWR
.2 Fluid State: Liquid
.3 Flow:
  .1 Normal (Operating): 29L/s
  .2 Maximum (Full Scale): 29 L/s
.4 Pressure:
  .1 Normal (Operating): 450 kPag
  .2 Maximum (Full Scale): 600 kPag
.5 Temperature:
  .1 Normal (Operating): 90°C
  .2 Maximum (Full Scale): 121°C
.6 Design Pressure: 1100 kPag
.7 Design Temperature: 121 °C
.8 Lower SG/Density: 1/658.37 kg/m3
.9 Higher SG/Density: 1/658.37 kg/m3

.3 Piping Data

.1 Pipe Material: Steel, Grade B Schedule 40
.2 Nominal Diameter: 6 inch

.4 Process Connections

.1 Flange Type: ANSI B16.5, Class 150
.2 Connection Size: See P&ID

.5 Transmitter Specifications

.1 Output: 4-20 mA
.2 Power Supply: 24 VDC
.3 Display: LCD with backlight
.4 Mounting: Remote Transmitter Display complete with mounting accessories
.5 Enclosure: IP67, explosion-proof
.6 Electrical Connection: 4x1/2” NPT

.6 Compliance and Certifications

.1 Certifications: CSA

2.5 FLOW SWITCHES

.1 Requirements:

.1 Paddle Type
.2 Fluid: Water
.3 Temperature Range: 0°C to 149°C
.4 Output: Two SPDT (1-NO, 1-NC)
.5 Power: 120VDC
.6 Enclosure: NEMA4X
.7 Stainless Steel Body and paddles

.2 Acceptable products: Series FS7-4 McDonnell & Miller

.1 Or approved equal in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment according to manufacturer’s written installation instructions, including all equipment and parts shipped loose.

.2 Mount control equipment according to manufacturer’s instructions and Section 26 05 00 – Common Works Results – Electrical.

.3 Install wiring between control devices as specified in Section 26 05 21 – Wires and Cables.

.4 Bundle, train, and support wiring in enclosures.

.5 Identify components along with power and control wiring according to Section 26 05 00 – Common Works Results – Electrical.

Part 4 Process Control Narrative

4.1 GENERAL

.1 Process control narrative for new and existing equipment is outlined in the following sections. Refer to Appendix B Commissioning plan for additional details.

.2 The Boiler Building is part of the ongoing NEWPCC DCS Migration project. The Boiler Building migration has an expected completion date near the end of 2025. Contractor to coordinate demolition and reconnection of signal cabling with the DCS Migration project.

4.2 BOILER CIRCULATION PUMPS

.1 New boiler circulating pumps P-B0110 and P-B0120 will be dedicated to boiler BLR-B0005 and BLR-B0006, respectively. New boiler circulating pump P-B0130 is a spare, which may be used for either BLR-B0005 and BLR-B0006. An operator can manually position the isolation valves of the spare pump to direct it to one of the new boilers.

.2 New boiler circulating pumps P-B0110, P-B0120 and P-B0130 are controlled by VFD. New circulation pumps shall be turned on when called by the PCS. However, pumps should also be able to be manually turned on by operators using a local hand switch. Pump run status will be sent to the plant PCS. Pump flowrate will be read by a flowmeter, dedicated to each boiler, and sent to the PCS for indication purposes.

.3 Pumps P-B0110, P-B0120 and P-B0130 shall be interlocked with boilers BLR-B0005 and BLR-B0006, such that when their dedicated boiler is enabled, the PCS shall also start the pump. If a pump is called to start by a boiler enable signal from a completely off state (ie. no flow), the pump shall turn on and ramp to achieve the flow set point of 29 L/s (operating flow mode).

.4 If a boiler is disabled, its dedicated circulation pump shall automatically ramp down to 15 L/s (low flow mode). This low flowrate shall be confirmed and set in the PCS during commissioning. If a pump is currently operating in the low flow state and its dedicated boiler is enabled through the plant PCS, the pump shall ramp to achieve 29 L/s.

.5 A circulating pump should normally either be operating in the high flow state when its dedicated boiler is enabled or in the low flow state when its dedicated boiler is disabled. A pump shall be able to be manually turned off by an operator through the PCS HMI or locally in the field.

4.3 EXISTING BOILER PUMP P-B0140 and LOW-FLOW PUMP P-B0150 CONTROL

.1 Existing boiler circulating pump P-B0140 (previously BP-5C) is dedicated to existing boiler BLR-B0007 (previously B-5C). The purpose of existing low flow circulation pump P-B0150 (previously BP-5D) is to maintain freeze protection for boiler BLR-B0007.

.2 Existing boiler circulation pump P-B0140 operates at a constant speed. This existing circulation pump is turned on manually by the operators using a local hand switch. A pump run status is sent to the plant PCS. BLR-B0007 and P-B0140 shall be programmatically interlocked such that BLR-B0007 can only run when pump P-B0140 is operating.

.3 Existing boiler low flow circulation pump P-B0150 operates at a constant speed and is turned on/off by a local hand switch. It shall be interlocked with pump P-B0140, using an enable signal from the plant PCS, such that it will only operate if pump P-B0140 is not operating. Run status and flowrate shall be sent to the PCS. Modifications of pump P-

B0150 control wiring will be required for this pump to be connected from the existing DCS to the new PCS.

4.4 BOILER BLR-B0005 and BLR-B0006 CONTROL

.1 The new boilers BLR-B0005 and BLR-B0006 will be staged on manually by operators, depending on the amount of supplemental heating required by the facility.

.2 Boilers shall have three modes of operation as shown below. An operator will be able to select the operation mode of a boiler through the HMI.

.1 Cascade mode

.2 Manual mode

.3 Auto mode

.3 Boiler Start-up Sequence:

.1 The operator shall be able to enable the boiler from the plant PCS HMI. The boiler must be in an enabled state before the operator can manually start the boiler from its local control panel in the field. Upon the operator pressing the “Boiler Enable” button on the PCS HMI, the PCS shall:

.1 Start (if it was idle) the boiler’s dedicated circulation pump and have it ramp to 29 L/s. If the pump is already running, the pump will be commanded to change its speed to output 29 L/s.

.1 Note that the pump must be in “AUTO” at its local control switch in order for the PCS to have control over the pump behaviour.

.2 The PCS will monitor the pump run status from the pump starter and the flow rate from the boiler flowmeter.

.3 When the pump has maintained operation of 29 L/s for at least 15 seconds, the PCS shall send a permissive signal to the boiler control panel.

.2 When the interlock is active, but the boiler has not yet been started, the PCS shall display a “Boiler Enabled” indication on its HMI.

.3 After the enable signal is sent to the boiler, an operator shall turn on the boiler from its local control panel. The boiler will start-up according to the manufacturer’s control sequence.

.4 Cascade Mode:

.1 Cascade mode shall allow the NEWPCC boiler system Plant Master to control the temperature or control output of the boiler. Cascade mode will be a selectable button on the HMI by an operator for each boiler. This is an existing system at NEWPCC, which the new boilers must be integrated into.

.2 Each boiler selected to operate in Cascade mode shall be controlled by the plant Master. Boilers are selected to operate in Cascade mode individually. Other boilers not selected to operate in Cascade mode, may run in the individual Auto or Manual modes.

.3 The Boiler Plant Master is an existing system at NEWPCC, which controls all boilers set to Cascade mode via the PCS HMI. The Plant Master itself may be set to Manual mode or Auto mode.

.1 In Auto mode, an operator selects the overall desired hot water temperature to be delivered to the secondary heating loop from the hot water mixing tank. Temperature feedback for the water being delivered to the secondary loop is gathered by a temperature transmitter on the secondary loop header and the signal is sent back to the PCS. Based on

the desired temperature selected by an operator and the feedback from the temperature transmitter, the Plant Master sends signals to each boiler to control their own HWS temperature output set points. Each boiler receives the same temperature setpoint signal.

.1 Note: Cascade Auto mode is the normal operating mode for the NEWPCC boiler system.

.2 In Manual mode, an operator selects the overall desired control output (firing rate) for the boiler system. The Plant Master sends signals to each boiler to modulate their own control output (firing rate), to achieve the overall plant control output selected on the Plant Master. All boilers set to cascade mode will be treated as one homogenous unit – each boiler will receive the same signal.

.1 Note: Cascade Manual mode shall only be used during abnormal process operating conditions or special circumstances. While this operating mode is used, operations staff must directly monitor and supervise the behaviour of the boiler.

.4 The new boilers shall be fully integrated with the existing Plant Master system at NEWPCC. The PCS shall be able to control the new boilers in both Auto mode and Manual mode via the Plant Master. The new boilers shall be capable of receiving control output (firing rate) and temperature signals from the PCS and Plant Master and modulating their firing rate, or other required parameters, to achieve the desired HWS temperature or control output, called for by the Plant Master.

.5 Manual Mode:

.1 Manual mode shall allow an operator to control the heat capacity output (firing rate) of the boiler. Manual mode will be a selectable button on the HMI by an operator.

.2 The operator will be able to select the desired output capacity (firing rate) of the boiler on a scale from 25% - 100% from the boiler HMI. (25% being minimum boiler heat output capacity and 100% being maximum boiler heat output capacity – exact percentage to be determined during commissioning).

.3 The PCS shall send the selected output capacity (firing rate) to the boiler's local control panel. The boiler manufacturer's controls will receive the signal and modulate the boiler's firing rate, and other required parameters, to achieve the desired control output (firing rate) from the boiler.

.4 Note: Manual mode shall only be used during abnormal process operating conditions or special circumstances. While this operating mode is used, operations staff must directly monitor and supervise the behaviour of the boiler.

.6 Auto Mode:

.1 Auto mode shall allow an operator to control the target hot water setpoint (HWS) of the water leaving the boiler. Auto mode will be a selectable button on the HMI by an operator.

.2 The operator will be able to select the desired HWS temperature set point for the boiler from the HMI.

.3 The PCS shall send the temperature setpoint to the boiler's local control panel. The boiler manufacturer's controls will receive the signal and modulate the boiler's firing rate, and other required parameters, to achieve the desired HWS temperature output from the boiler.

.4 Note: Auto mode shall only be used during abnormal process operating conditions or special circumstances. While this operating mode is used, operations staff must directly monitor and supervise the behaviour of the boiler.

.7 Boiler Disable:

.1 A boiler shall be able to be disabled via the PCS HMI or through the boiler's local control panel.

.2 If a boiler is disabled, its dedicated pump shall ramp down to its low flow mode flow rate.

.3 If a boiler is ever shutdown due to a fault, abnormal condition, safety device or manually via the local control panel or PCS, the boiler shall be disabled. For the boiler to be restarted, it must be enabled again using the HMI, prior to being turned on at its local control panel.

.8 Boiler Fault:

.1 A Boiler Fault alarm will be input to the plant PCS based on a common alarm generated from the boiler internal controller. The operator will be required to investigate the boiler alarm locally. Once the alarm condition is no longer active in the field the operator shall be able to acknowledge the alarm on the plant PCS.

.9 Abnormal Operation:

.1 If the flowmeter dedicated to an operating boiler reads low flow, an alarm shall triggered on the PCS for indication purposes only. Low flow set point to be determined during commissioning.

.2 The flow switch on the discharge side of boiler is wired directly to the boiler control panel. If the flow switch senses low flow, this signal will trigger the local boiler controller to shut the boiler down. In addition, the shutdown shall trigger an alarm on the PCS for indication only.

.3 If the boiler low water cutoff switch senses low water levels, it shall send a signal to the boiler to shutdown. This function will be directly wired to the local boiler control panel and controller. This shutdown shall trigger an alarm on the PCS for indication only.

.4 Dedicated boiler E-stop pressed in field. Boiler to shutdown and trigger alarm on PCS HMI. Pressing the e-stop will clear the "enabled" status at the PCS HMI. Operators will be required to reset the e-stop button and re-enable the boiler at the PCS prior to restarting the boiler.

.5 If a boiler shutdown occurs, the "enabled" status at the PCS will be removed. Operators will be required to repeat the boiler enable process at the PCS prior to restarting the boiler.

4.5 Boiler BLR-0007 Control

.1 The operator shall be able to enable boiler BLR-B0007 from the plant PCS. The Boiler Enable signal shall be on when:

.1 The operator sets the boiler to enable, and

.2 the pump run status for the circulation pump associated with the boiler has been received.

.2 Once the boiler receives the Boiler Enable signal from the plant PCS the operator shall be able to manually turn the boiler on using the "Burner Enable" switch on the local HMI. The boiler will operate using its internal controller. The boiler is configured to modulate firing rate based on boiler inlet temperature, which is the return water temperature from the hot water mixing tank in the primary boiler loop. The boiler is set to maintain a return water temperature of 95 °C, with a modulation range between 92 °C and 98 °C. At 92 °C return water, the boiler will begin to fire and heat the primary heating loop. If the return water exceeds 98 °C, the boiler will stop firing. The boiler temperature set point and modulation range may be configured by an operator on the local boiler HMI.

.3 The maximum outlet temperature for the boiler is limited to approximately 108 °C by the boiler internal control system.

.4 Flow and low water level cutoff switches will remain directly wired to the internal boiler controller.

.5 A Boiler Fault alarm will be input to the plant PCS based on a common alarm generated from the boiler internal controller. The operator will be required to investigate the boiler alarm locally. Once the alarm condition is no longer active in the field the operator shall be able to acknowledge the alarm on the plant PCS.

END OF SECTION