



**THE CITY OF WINNIPEG**

# **NMS SPECIFICATIONS**

**BID OPPORTUNITY NO. 247-2018**

**PAN AM POOL – MAIN POOL PUMPS AND MOTOR CONTROL CENTRE  
UPGRADE**

**Part 1            General**

**1.1                WORK COVERED BY CONTRACT DOCUMENTS**

- .1        Work of this Contract comprises the supply and installation of the two (2) main pool pumps and the associated motor control centre for the Pan Am Pool located at 25 Poseidon Bay, Winnipeg, Manitoba.

**1.2                CONTRACT METHOD**

- .1        Construct Work under stipulated price contract.

**1.3                CONTRACTOR USE OF PREMISES**

- .1        Limit use of premises for Work, for storage, and for access, to allow:
  - .1        City occupancy.
  - .2        Work by other contractors.
  - .3        Public usage.
- .2        Co-ordinate use of premises under direction of Prime Contractor and the City's Representative.
- .3        Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4        Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5        Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Contract Administrator.
- .6        At completion of operations condition of existing work: equal to or better than that which existed before new work started.

**1.4                CITY OCCUPANCY**

- .1        City will occupy premises during entire construction period for execution of normal operations.
- .2        Co-operate with City in scheduling operations to minimize conflict and to facilitate the City's usage.
- .3        Work requiring the temporary shutdown of the facilities in whole or part shall be not be performed during normal City operations. This work shall be performed during nighttime hours.

**1.5 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to building operations, occupants, public and normal use of premises. Arrange with Contract Administrator to facilitate execution of work.

**1.6 EXISTING SERVICES**

- .1 Notify Contract Administrator and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Contract Administrator 48 hours' notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with no disturbance to City operations.
- .3 Submit schedule to and obtain approval from Contract Administrator for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**1.7 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one (1) copy of each document, as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.
  - .6 Change Orders.
  - .7 Other Modifications to Contract.
  - .8 Field Test Reports.
  - .9 Copy of Approved Work Schedule.
  - .10 Health and Safety Plan and Other Safety Related Documents.
  - .11 Other documents as specified.

**Part 2 Products NOT USED**

**Part 3 Execution NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                ACCESS AND EGRESS**

- .1      Design, construct, and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders, and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

**1.2                USE OF SITE AND FACILITIES**

- .1      Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Contract Administrator to facilitate work as stated.
- .2      Maintain existing services to building and provide for personnel and vehicle access.
- .3      Maintain existing fire truck access.
- .4      Where security is reduced by work provide temporary means to maintain security.
- .5      Contractor to provide sanitary facilities
- .6      Closures: protect work temporarily until permanent enclosures are completed.

**1.3                BUILDING SMOKING ENVIRONMENT**

- .1      Comply with smoking restrictions. Smoking is not allowed.

**Part 2            Products NOT USED**

**Part 3            Execution 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        Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .4        Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .5        Verify field measurements and affected adjacent Work is co-ordinated.
- .6        Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .7        Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .8        Keep one (1) reviewed copy of each submission on site.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit one (1) electronic copy of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.
- .2        Submit one (1) electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.
- .3        Submit one (1) electronic copy of test reports for requirements requested in specification Sections and as requested by Contract Administrator.
  - .1        Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  - .2        Testing must have been within three (3) years of date of contract award for project.
- .4        Submit one (1) electronic copy of certificates for requirements requested in specification Sections and as requested by Contract Administrator.

- .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
- .2 Certificates must be dated after award of project contract complete with project name.
- .5 Submit one (1) electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Contract Administrator.
  - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .6 Submit one (1) electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Contract Administrator.
  - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .7 Submit one (1) electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.
- .8 Delete information not applicable to project.
- .9 Supplement standard information to provide details applicable to project.
- .10 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .11 Contractor will be charged for Contract Administrator subsequent reviews of submittal packages exceeding two (2) submissions.

**Part 2 Products NOT USED**

**Part 3 Execution NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2        Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1        Material Safety Data Sheets (MSDS).
- .3        Province of Manitoba
  - .1        Workplace Safety and Health Act, R.S.M. 1987.

**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 seven (7) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
  - .1        Results of site specific safety hazard assessment.
  - .2        Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3        Submit two (2) copies of Contractor's authorized representative's work site Health and Safety inspection reports to Contract Administrator and authority having jurisdiction, weekly.
- .4        Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5        Submit copies of incident and accident reports.
- .6        Submit WHMIS MSDS - Material Safety Data Sheets.
- .7        Contract Administrator will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five (5) days after receipt of plan. Revise plan as appropriate and resubmit plan to Consultant within five (5) days after receipt of comments from Contract Administrator.
- .8        Contract Administrator's review of Contractor's final Health and Safety Plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9        Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Contract Administrator.
- .10      On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

### **1.3 FILING OF NOTICE**

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.

### **1.4 SAFETY ASSESSMENT**

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

### **1.5 MEETINGS**

- .1 Schedule and administer Health and Safety meeting with Contract Administrator prior to commencement of Work.

### **1.6 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.
- .2 Contract Administrator may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

### **1.7 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.

### **1.8 COMPLIANCE REQUIREMENTS:**

- .1 Comply with Workplace Safety and Health Act, Workplace Safety Regulation, Manitoba Reg. R.S.M 1987.

### **1.9 UNFORSEEN 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.

### **1.10 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 minimum two (2) years' site-related working experience specific to activities associated with Health and Safety.
  - .2 Have working knowledge of occupational Health and Safety regulations.



- .3 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.
- .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .5 Be on site during execution of Work.

**1.11 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, and in consultation with Contract Administrator.

**1.12 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address Health and Safety non-compliance issues identified by authority having jurisdiction or by Contract Administrator.
- .2 Provide Contract Administrator with written report of action taken to correct non-compliance of Health and Safety issues identified.
- .3 Contract Administrator may stop Work if non-compliance of Health and Safety regulations is not corrected.

**1.13 POWDER ACTUATED DEVICES**

- .1 Use powder actuated devices only after receipt of written permission from Contract Administrator.

**1.14 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 NOT USED**

**Part 3 Execution NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

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

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3                INSTALLATION AND REMOVAL**

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

**1.4                SCAFFOLDING**

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, temporary stairs,.

**1.5                HOISTING**

- .1 Provide, operate and maintain hoists, cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists, cranes to be operated by qualified operator.

**1.6                SITE STORAGE/LOADING**

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

**1.7                CONSTRUCTION PARKING**

- .1 Parking will be permitted on site in public parking areas provided it does not disrupt performance of Work.

- .2 Provide and maintain adequate access to project site including fire route access

**1.8 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.

**1.9 SANITARY FACILITIES**

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

**1.10 CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Store materials resulting from demolition activities that are salvageable.
- .3 Stack stored new or salvaged material not in construction facilities.

**Part 2 Products**

**NOT USED**

**Part 3 Execution**

**NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                INSTALLATION AND REMOVAL**

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

**1.2                HOARDING**

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

**1.3                GUARD RAILS AND BARRICADES**

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

**1.4                WEATHER ENCLOSURES**

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

**1.5                DUST TIGHT SCREENS**

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

**1.6                ACCESS TO SITE**

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

**1.7                PUBLIC TRAFFIC FLOW**

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

**1.8 FIRE ROUTES**

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

**1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

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

**1.10 PROTECTION OF BUILDING FINISHES**

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

**Part 2 Products NOT USED**

**Part 3 Execution NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2        If there is question as to whether products or systems are in conformance with applicable standards, Contract Administrator reserves right to have such products or systems tested to prove or disprove conformance.
- .3        Cost for such testing will be borne by Contractor.

**1.2                QUALITY**

- .1        Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2        Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials, and in otherwise utilizing recycled and recovered materials in execution of Work.
- .3        Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4        Should disputes arise as to quality or fitness of products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.
- .5        Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6        Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

**1.3                AVAILABILITY**

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

#### **1.4 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Consultant.
- .9 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

#### **1.5 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.

#### **1.6 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

#### **1.7 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site, workers deemed incompetent or careless.

- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator, whose decision is final.

### **1.8 CO-ORDINATION**

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

### **1.9 CONCEALMENT**

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

### **1.10 LOCATION OF FIXTURES**

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Contract Administrator of conflicting installation. Install as directed.

### **1.11 FASTENINGS**

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

### **1.12 FASTENINGS - EQUIPMENT**

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.



- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

**1.13 PROTECTION OF WORK IN PROGRESS**

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Contract Administrator.

**1.14 EXISTING UTILITIES**

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

**Part 2 Products NOT USED**

**Part 3 Execution NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.2                MATERIALS**

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

**1.3                PREPARATION**

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

**1.4 EXECUTION**

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

**Part 2 Products NOT USED**

**Part 3 Execution NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                PROJECT CLEANLINESS**

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

**END OF SECTION**

Main Pool Pumps and Motor Control Centre Upgrade

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**Part 1 General**

**1.1 REFERENCES**

- .1 Unless otherwise noted, refer to the latest references and standards listed herein adopted by the local Authority Having Jurisdiction.

**1.2 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings to show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances.
- .3 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.
- .4 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.
- .5 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.
  - .2 Operation and maintenance manual reviewed by, and final copies deposited with, Consultant 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.
    - .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.
- .6 Reviews:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for review. Submission of individual data will not be accepted unless directed by Consultant.
  - .2 Make changes as required and re-submit as directed by Consultant.
- .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 Consultant will provide white prints of the mechanical drawings. 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 white prints, revising white prints 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, 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 Consultant for review and make corrections as directed.
  - .4 Perform testing, adjusting and balancing 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.

### 1.3 QUALITY ASSURANCE

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

Main Pool Pumps and Motor Control Centre Upgrade

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**1.4 DELIVERY, STORAGE, AND HANDLING**

.1 Waste Management and Disposal:

- .1 Construction/Demolition Waste Management and Disposal: in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used

**Part 3 Execution**

**3.1 DEMOLITION**

.1 Preparation

- .1 Coordinate utility service outages with utility company and schedule utility to locate buried services.
- .2 Provide temporary connections to maintain existing system in service during construction. When Contractor elects to perform Work on energized equipment, use personnel experienced in such operations.
- .3 Beginning of demolition means installer accepts existing conditions.

.2 Demolition

- .1 Connect equipment which is existing and is to remain to the new system as required to maintain its proper operation.
- .2 Maintain access to existing mechanical installations which remain active. Modify installation or provide access as appropriate.

.3 Scheduling and Phasing

- .1 Prior to the start of any demolition Work within the building, provide the Consultant a schedule of phased selective demolition for all mechanical demolition at the site.
- .2 Provide the following information for the schedule:
- .1 Number of phases of demolition.
- .2 Limits of each phase.
- .3 Dates of start/finish demolition by phase.
- .4 Critical dates for disruptions in mechanical systems.
- .5 Dates and duration of temporary measures to maintain occupancy in adjacent areas.
- .3 Coordinate the mechanical demolition schedule with all aspects of demolition under other Divisions of the specifications.

**3.2 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.

**3.3 CLEANING**

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

**3.4 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.

**3.5 DEMONSTRATION**

- .1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 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.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.

**3.6 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                REFERENCES**

- .1            American Society of Mechanical Engineers (ASME).
  - .1            ASME B40.100, Pressure Gauges and Gauge Attachments.
- .2            Canadian General Standards Board (CGSB).
  - .1            CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

**1.2                SUBMITTALS**

- .1            Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Submit manufacturer's product data for following items:
  - .1            Pressure gauges.

**Part 2            Products**

**2.1                GENERAL**

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

**2.2                ACCEPTABLE PRODUCTS MANUFACTURERS**

- .1            Marsh Bellofram.
- .2            H.O. Trerice.

**2.3                PRESSURE GAUGES**

- .1            112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel or phosphor bronze bourdon tube having point five percent (0.5%) accuracy full scale unless otherwise specified.
- .2            Provide:
  - .1            Snubber for pulsating operation.
  - .2            Gasketed pressure relief back with solid front.
  - .3            Bronze stop cock.
  - .4            Oil filled for high vibration applications.

**Part 3 Execution**

**3.1 GENERAL**

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

**3.2 PRESSURE GAUGES**

- .1 Install in following locations:
  - .1 Suction and discharge of pumps.
  - .2 Install gauge cocks for balancing purposes.

**3.3 NAMEPLATES**

- .1 Install engraved lamicoid nameplates as specified in Section 23 05 54 - Mechanical Identification, identifying medium.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3, Identification of Piping Systems.

**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 or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

| Size # | Sizes (mm) | No. of Lines | Height of Letters (mm) |
|--------|------------|--------------|------------------------|
| 1      | 20 x 100   | 2            | 5                      |
| 2      | 35 x 200   | 1            | 20                     |
  - .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
  - .1 Terminal cabinets, control panels: use size #1.
  - .2 Equipment in Mechanical Rooms: use size #2.

**2.3 VALVES, CONTROLLERS**

- .1 3 mm thick plastic laminated, with matte finished tags with letters accurately aligned and machine engraved into core. Red background for normally closed valves and green background for normally open valves.
- .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.

**2.4 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 Painted full circumference and length of pipe or insulation.
- .6 Colours and Legends:
  - .1 Where not listed, obtain direction from Consultant.
  - .2 Colours for legends, arrows: to following table:

| Background colour: | Legend, arrows: |
|--------------------|-----------------|
| Yellow             | BLACK           |
| Brown              | BLACK           |
| Green              | WHITE           |
| Red                | WHITE           |

- .3 Background colour marking for piping system to match existing.

**2.5 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.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Perform Work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and or CSA registration plates as required by respective agency.

**3.2 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.

**3.3 LOCATION OF IDENTIFICATION ON PIPING SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 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 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.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    Associated Air Balance Council (AABC).
  - .1        AABC National Standards for Total System Balance.
  - .2        AABC Test and Balance Procedures.

**1.2                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.

**1.3                SCOPE OF WORK**

- .1    The mechanical contractor will contract with an independent testing, adjusting, and balancing (TAB) agency to test, adjust, and balance the pool recirculation system.
- .2    The Work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the pool recirculation system, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results.
- .3    The items requiring testing, adjusting, and balancing include but are not limited to the following:
  - .1        The new pumps.

**1.4                QUALIFICATIONS**

- .1    Agency Qualifications: The TAB Agency shall be a current member of the Associated Air Balance Council (AABC).
- .2    Provide documentation to the consultant, upon request, confirming qualifications and successful experience in hydronic system balancing.

**1.5                SUBMITTALS**

- .1    Submit, prior to commencement of TAB:
  - .1        Procedures and Agenda: The TAB agency shall submit the TAB procedures and agenda proposed to be used.
  - .2        Sample Forms: The TAB agency shall submit sample forms, which shall include the minimum data required by the AABC National Standards.

- .3 Proposed methodology and procedures for performing TAB if different from referenced standard.
- .4 Submit names of personnel to perform TAB to Consultant within thirty (30) days of award of contract.
- .2 Qualifications: The TAB agency shall submit a company resume listing personnel and project experience in hydronic system balancing and a copy of the agency's test and balance Engineer (TBE) certificate.
- .3 Test results, observations and settings, as specified.

#### **1.6 TAB PREPARATION AND COORDINATION**

- .1 Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB Work shall be provided to the TAB agency no later than thirty (30) days prior to the start of TAB Work.
- .2 System installation and equipment startup to be complete prior to the TAB agency's being notified to begin.
- .3 The building control system shall be complete and operational. The Building Control System contractor shall install all necessary components and software, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.
- .4 All test points, balancing devices, identification tags, etc. shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
- .5 Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

#### **1.7 REPORTS**

- .1 Final TAB Report - The TAB agency shall submit the final TAB report for review by the Consultant. All outlets, devices, equipment, etc., shall be identified, along with a numbering system corresponding to report unit identification. The TAB agency shall submit an AABC "National Project Performance Guaranty" assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications and AABC National Standards.
- .2 Format in accordance with TAB standards of AABC.
- .3 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .4 Submit copy of TAB Report to Contract Administrator for verification and approval.

#### **1.8 DEFICIENCIES**

- .1 Any deficiencies in the installation or performance of a system or component observed by the TAB agency shall be brought to the attention of the Contract Administrator.

- .2 The Work necessary to correct items on the deficiency listing shall be performed and verified by the affected contractor before the TAB agency returns to retest. Unresolved deficiencies shall be noted in the final report.

## **1.9 VERIFICATION**

- .1 Reported results subject to verification by Contract Administrator.
- .2 Provide personnel and instrumentation to verify up to thirty percent (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.

## **Part 2 Products**

### **2.1 INSTRUMENTATION**

- .1 All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of AABC National Standards.
- .2 Calibrate within three (3) months of TAB. Provide certificate of calibration to Consultant, upon request.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with AABC National Standards. Adjustment tolerances shall be + or – ten percent (10%) unless otherwise stated.
- .2 Equipment settings, including manual valve indicators and similar controls and devices shall be marked to show final settings.
- .3 All information necessary to complete a proper TAB project and report shall be per AABC standards unless otherwise noted. The descriptions for Work required, as listed in this section, are a guide to the minimum information needed.
- .4 The TAB agency shall, as applicable, confirm that all hydronic equipment and piping have been filled and purged; that strainers have been cleaned; and that all balancing valves (except bypass valves) are set full open. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards:
  - .1 For pumps:
    - .1 Test and adjust pumps to achieve maximum or design flow. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Record appropriate gauge readings for final TDH and Block-Off/Dead head calculations.



- .2 Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.
- .2 For system mains and branches:
  - .1 Adjust water flow in pipes to achieve maximum or design flow.
- .5 Preconstruction Plan Check and Review:
  - .1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
  - .2 Review specified standards and report to Consultant in writing proposed procedures which vary from standard.
  - .3 The TAB agency shall review the project documents and contractor submittals for their effect on the TAB process and overall performance of the system. It shall submit recommendations for enhancements or changes to the system within 30 days of document review.
- .6 Job Site Inspections:
  - .1 During construction, the TAB agency shall inspect the installation of pipe systems and other component parts of the pool recirculation system. Inspections shall be conducted a minimum of two (2) times. (Typically, these are performed when sixty percent (60%) of the total system is installed and again when ninety percent (90%) of the total system is installed, prior to insulation of the piping). The TAB agency shall submit a written report of each inspection.
- .7 Systems Start-Up:
  - .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
  - .2 Follow and coordinate all specified start-up procedures.
  - .3 Start TAB when the installation of the pumps are essentially completed, including:
    - .1 Pressure, leakage, other tests specified elsewhere Division 23.
    - .2 All provisions for TAB are installed and operational.
- .8 Start-up verification of mechanical and associated electrical systems affecting TAB for proper, normal and safe operation including, but not limited to:
  - .1 Proper thermal overload protection in place for electrical equipment.
  - .2 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.
  - .3 Chemical treatment systems complete, operational.
- .9 Settings:

- .1 After TAB is completed to satisfaction of Consultant, 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.
- .10 TAB Report Verification:
- .1 At the time of final inspection, the TAB agency will be required to recheck, in the presence of the Consultant, specific or random selections of data recorded in the certified report. Points and areas for recheck shall be selected by the Consultant. Measurements and test procedures shall be the same as approved for the initial Work for the certified report. Selections for recheck, specific plus random, will not exceed one day on site.
  - .2 Reported results subject to verification by Consultant.
  - .3 Provide personnel and instrumentation to verify up to thirty percent (30%) of reported results.
  - .4 Number and location of verified results as directed by Consultant.
  - .5 Pay costs to repeat TAB as required to satisfaction of Consultant.
- .11 TAB shall be 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 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), SMACNA 1780, HVAC Systems – Testing, Adjusting and Balancing – 2002.
- .12 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
- .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC), requirements and recommendations contained in these procedures and requirements are mandatory.
  - .3 Recommendations and suggested practices contained in the TAB Standard are mandatory.
  - .4 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
  - .5 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
  - .6 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .13 Other TAB Requirements:
- .1 General requirements applicable to Work specified this paragraph:
    - .1 Qualifications of TAB personnel: as for hydronic systems specified this section.

- .2 Quality assurance: as for hydronic systems specified this section.
- .3 Coordinate with controls contractor.
- .2 Measurement of noise and vibration from equipment specified in Division 23.
  - .1 Standard: TAB to most stringent of TAB standards of AABC.
- .14 Post-Occupancy TAB
  - .1 Contractor shall make provisions for one additional measurement and adjustment of hydronic systems to satisfy Consultant's requirements following issue of final TAB report.
- .15 Completion of TAB:
  - .1 TAB considered complete when final TAB Report received and approved by Consultant.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Electrical Equipment Manufacturers Advisory Council (EEMAC).
- .2        National Electrical Manufacturers Association (NEMA).
  - .1        NEMA MG 1, Motors and Generators.

**1.2                SUBMITTALS**

- .1        Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        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.
- .3        Submit product data of pump curves for review showing point of operation.
- .4        Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.
- .5        Provide maintenance data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.

**Part 2            Products**

**2.1                RECIRCULATION PUMPS (P-1 & P-2)**

- .1        Volute: cast iron radially split, with screwed or flanged design suction and discharge connections.
- .2        Impeller: bronze.
- .3        Shaft: steel with bronze sleeve bearing.
- .4        Seal assembly: ceramic mechanical seal.
- .5        Motor: premium efficiency, 1750 rpm.
- .6        Capacity: 2800 USGPM @ 80 ft. of head, 75 hp. motor, 600 V/3phase.
- .7        c/w protective cover.
- .8        Acceptable materials: Equal to PLAD type LF Model 8012-3, size: 8"x10"x12"

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.
- .2 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.
- .3 Install volute venting pet cock in accessible location.
- .4 Check rotation prior to start-up.

**3.2 START-UP**

- .1 General
- .2 In accordance with manufacturer's recommendations.
- .3 Procedures:
  - .1 After starting pump, check for proper, safe operation.
  - .2 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
  - .3 Check base for free-floating, no obstructions under base.
  - .4 Run-in pumps for 12 continuous hours.
  - .5 Verify operation of over-temperature and other protective devices under low- and no-flow condition.
  - .6 Eliminate air from scroll casing.
  - .7 Adjust alignment of piping and conduit to ensure true flexibility at all times.
  - .8 Eliminate cavitation, flashing and air entrainment.

**3.3 PERFORMANCE VERIFICATION (PV)**

- .1 General
  - .1 In accordance with manufacturer's recommendations.
- .2 Assumptions: these PV procedures assume that:
  - .1 Manufacturer's performance curves are accurate.
  - .2 Valves on pump suction and discharge provide tight shut-off.
- .3 Multiple Pump Installations - Series and Parallel:
  - .1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.
- .4 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

- .5 Commissioning Reports: Reports to include:
  - .1 Record of point(s) of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.
  - .2 Pump performance curves (family of curves).

**END OF SECTION**

Main Pool Pumps and Motor Control Centre Upgrade

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**Part 1 General**

**1.1 SUMMARY**

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

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
  - .2 CAN3-C235-[83(R2000)], Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.3 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates for control items in English.

**1.4 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures
- .2 Quality Control:
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to Site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of contract.

- .5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
- .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.
- .3 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within THREE (3) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

## **1.5 QUALITY ASSURANCE**

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

## **1.6 SYSTEM STARTUP**

- .1 Instruct City personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

## **Part 2 Products**

### **2.1 MATERIALS AND EQUIPMENT**

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

### **2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

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



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- .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 inspection authorities.
- .2 Lamacoid signs, minimum size 175 x 250 mm.

**2.4 WIRING TERMINATIONS**

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

**2.5 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates as follows:
  - .1 Nameplates: lamacoid 3 mm thick plastic engraving sheet, black with 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  |
| 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  |

- .2 Wording on nameplates to be approved Contract Administrator prior to manufacture.
- .3 Allow for minimum of twenty-five (25) letters per nameplate.
- .4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .6 Terminal cabinets and pull boxes: indicate system and voltage.
- .7 Transformers: indicate capacity, primary and secondary voltages.

**2.6 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.

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- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

**2.7 CONDUIT AND CABLE IDENTIFICATION**

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

|                             | Prime  | Auxiliary |
|-----------------------------|--------|-----------|
| up to 250 V                 | Yellow |           |
| up to 600 V                 | Yellow | Green     |
| Telephone                   | Green  |           |
| Other Communication Systems | Green  | Blue      |
| Fire Alarm                  | Red    |           |
| Emergency Voice             | Red    | Blue      |
| Other Security Systems      | Red    | Yellow    |

**2.8 FINISHES**

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

**Part 3 Execution**

**3.1 INSTALLATION**

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

**3.2 NAMEPLATES AND LABELS**

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

**3.3 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: schedule 40 steel pipe or 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.

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

**3.4 LOCATION OF OUTLETS**

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .3 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

**3.5 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1400 mm.
  - .2 Wall receptacles:
    - .1 General:300 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.
    - .4 In mechanical rooms: 1400 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Fire alarm stations: 150 0mm.
  - .5 Fire alarm bells: 2100 mm.

**3.6 CO-ORDINATION OF PROTECTIVE DEVICES**

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

**3.7 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 two percent (2%) of rated voltage of equipment.

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- .3 Provide upon completion of work, load balance report as directed in Part 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests :
  - .1 Power distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 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.
- .5 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.

**3.8 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**

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**Part 1            General**

**1.1                SECTION INCLUDES**

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

**1.2                REFERENCES**

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

**Part 2            Products**

**2.1                MATERIALS**

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

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Remove insulation carefully from ends of conductors and:

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

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

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

**1.2                REFERENCES**

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

**1.3                PRODUCT DATA**

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

**Part 2            Products**

**2.1                BUILDING WIRES**

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

**2.2                TECK CABLE**

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

- .8 Connectors:
  - .1 Watertight approved for TECK cable.

### **2.3 CONTROL CABLES**

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

## **Part 3 Execution**

### **3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduits Fastening and Conduits Fitting.

### **3.2 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.

### **3.3 INSTALLATION OF CONTROL CABLES**

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

**END OF SECTION**



**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Materials and installation for connectors and terminations.

**1.2                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA C22.2 No.2012 (22<sup>nd</sup> Edition)
  - .2        CSA C22.2 No.41-M1987 (R1999), Grounding and Bonding Equipment.

**1.3                PRODUCT DATA**

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

**Part 2            Products**

**2.1                CONNECTORS AND TERMINATIONS**

- .1        Copper long barrel compression connectors to CSA C22.2No.2 as required sized for conductors.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install terminations, and splices in accordance with manufacturer's instructions.
- .2        Bond and ground as required to CSA C22.2No.41.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Not Used

**Part 2            Products**

**2.1                SUPPORT CHANNELS**

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

**Part 3            Execution**

**3.1                INSTALLATION**

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

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- .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    Canadian Standards Association (CSA)
  - .1    CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
  - .2    CSA C22.2 No. 45-M1981(R1992), Rigid Metal Conduit.
  - .3    CSA C22.2 No. 56-1977(R1999), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4    CSA C22.2 No. 83-M1985(R1999), Electrical Metallic Tubing.
  - .5    CAN/CSA C22.2 No. 227.3-M91(R1999), Flexible Nonmetallic Tubing.

**Part 2            Products**

**2.1                CONDUITS**

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

**2.2                CONDUIT FASTENINGS**

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

**2.3                CONDUIT FITTINGS**

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

**2.4                EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1    Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.

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

## **2.5 FISH CORD**

- .1 Polypropylene.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 X-ray cast walls and floors before coring to confirm location of embedded items.
- .3 Existing structure contains asbestos. Confirm materials are free of asbestos before drilling or coring.
- .4 Use rigid aluminum threaded conduit in areas subject to mechanical injury.
- .5 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.
- .7 Minimum conduit size for lighting and power circuits: 19 mm.
- .8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 19 mm dia.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.

### **3.2 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.

- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

**3.3 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED WORK**

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

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA)
  - .1            CAN/CSA-Q9000, Quality Management and Quality Assurance Standards - Guidelines for Selection and Use.

**1.3                PRODUCT DATA**

- .1            Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Submit product data sheets for sills, bus bars and compartments. Include product characteristics, physical size and finish.
- .3            Manufacturers Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

**1.4                SHOP DRAWINGS**

- .1            Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Indicate:
  - .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 bus bars and details of provision for future extension.
  - .6            Schematic and wiring diagrams.

**1.5                CLOSEOUT SUBMITTALS**

- .1            Provide operation and maintenance data for motor control centre for incorporation into manual.
- .2            Include data for each type and style of starter.

**1.6                EXTRA MATERIALS**

- .1            Provide maintenance materials.
- .2            Include: five (5) control fuses, control transformer, H-O-A selector switch and contact blocks, and five (5) lamps

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**Part 2 Products**

**2.1 SUPPLY CHARACTERISTICS**

- .1 600 V, 60Hz, wye connected, 3 phase, 3 wire, grounded neutral.

**2.2 GENERAL DESCRIPTION**

- .1 Compartmentalized vertical sections with common power bus bars.
- .2 Floor mounting, free standing, enclosed dead front.
- .3 Indoor CSA 12 gasketed enclosure.
- .4 Class I Type B.

**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, minimum 305 mm high, 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 bus bars 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 with terminals.
- .8 Provision for outgoing cables to exit via top or bottom with terminals.
- .9 Removable lifting means.
- .10 Provision for future extension of both ends of motor control centre including bus bars without need for further drilling, cutting or preparation in field.
- .11 Divide assembly for shipment to Site, complete with hardware and instructions for re-assembly.

**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 high conductivity tin plated copper bus bars in separate compartment self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:
  - .1 Main horizontal bus bars: 600 A.
  - .2 Branch vertical bus bars: 300 A.
- .2 Branch vertical bus bars for distribution of power to units in vertical sections.
- .3 No other cables, wires, equipment in main and branch bus bar compartments.
- .4 Brace bus work to withstand effects of short-circuit current of 42kA rms symmetrical.
- .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.
- .2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

## **2.7 MOTOR STARTERS AND DEVICES**

- .1 Provide motor starters with required controls to interface with existing Metasys Control System. This includes start signals, running signals, fault signals, and current CTs.

## **2.8 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 three (3) padlocks 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 (1) manufacturer to facilitate maintenance.
- .8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

**2.9 WIRING IDENTIFICATION**

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

**2.10 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
  - .1 Motor control centre main nameplate: size No. 7
  - .2 Individual compartment nameplates: size No. 5.

**2.11 FINISHES**

- .1 Apply finishes in accordance with Section 26 05 00 - Common Work Results – For Electrical.
- .2 Paint motor control centre exterior light gray and interiors white.

**2.12 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.
- .3 Manufacturer to provide proof of quality control program in accordance with [CAN/CSA-Q9000].

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.
- .2 Make field power and control connections as indicated.
- .3 Ensure correct overload heater elements are installed.

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- .4 Make connections to Metasys Control System

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - 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 eight (8) hour period.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Materials for moulded-case circuit breakers.

**1.2                RELATED SECTIONS**

- .1            Section 01 33 00 - Submittal Procedures.

**1.3                REFERENCES**

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

**1.4                SUBMITTALS**

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

**Part 2            Products**

**2.1                BREAKERS GENERAL**

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

**2.2                THERMAL MAGNETIC BREAKERS**

- .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.

□

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Install circuit breakers as indicated.
- .2            Set adjustable trip settings.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

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

**1.2                RELATED SECTIONS**

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

**1.3                REFERENCES**

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

**1.4                SHOP DRAWINGS**

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

**1.5                QUALITY ASSURANCE**

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

**Part 2            Products**

**2.1                AC CONTROL RELAYS**

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

**2.2                RELAY ACCESSORIES**

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

**2.3                SOLID STATE TIMING RELAYS**

- .1        Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact.

□

- .2 Operation: on-delay or off-delay.
- .3 Potentiometer: self contained to provide time interval adjustment.
- .4 Supply voltage: 120 V, AC, 60 Hz.
- .5 Temperature range: minus 20 degrees C to 60 degrees C.
- .6 Output contact rating: maximum voltage 300 V AC or DC. Current: 2A
- .7 Timing ranges: field adjustable, minimum 0.1s, maximum 60 hr.

## **2.4 OPERATOR CONTROL STATIONS**

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

## **2.5 PUSHBUTTONS**

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

## **2.6 SELECTOR SWITCHES**

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

## **2.7 INDICATING LIGHTS**

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

## **2.8 CONTROL AND RELAY PANELS**

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

## **2.9 CONTROL CIRCUIT TRANSFORMERS**

- .1 Single phase, dry type.
- .2 Primary: 600 V, 60 Hz ac.
- .3 Secondary: 120 V, AC.
- .4 Rating: 150 VA, or larger as required.
- .5 Secondary fuse: ampacity as required.
- .6 Close voltage regulation as required by magnet coils and solenoid valves.

**Part 3 Execution**

**3.1 INSTALLATION**

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

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results – 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.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

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

**1.2                REFERENCES**

- .1            NEMA contactors and motor starters

**1.3                SHOP DRAWINGS AND PRODUCT DATA**

- .1            Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2            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                CLOSEOUT SUBMITTALS**

- .1            Provide operation and maintenance data for motor starters for incorporation into manual.
- .2            Include operation and maintenance data for each type and style of starter.

**1.5                EXTRA MATERIALS**

- .1            Provide maintenance materials.
- .2            Provide listed spare parts for each different size and type of starter:
  - .1            Three (3) contacts, stationary.
  - .2            Three (3) contacts, movable.
  - .3            One (1) contact, auxiliary.
  - .4            One (1) control transformer[s].
  - .5            One (1) operating coil.
  - .6            Two (2) fuses.
  - .7            Ten percent (10%) indicating lamp bulbs used.

**Part 2            Products**

**2.1                MATERIALS**

- .1            Starters: NEMA standards, IEC rated equipment not allowed.

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## 2.2 SOFT STARTERS

- .1 Design requirements:
  - .1 The Short Circuit Current Rating (SSCR) of the assembly must equal or exceed 18 kA.
  - .2 Ventilation system designed for ambient temperature range of 5°C to 35°C.
  - .3 Enclosure temperature not to exceed 40°C.
- .2 Soft Starter Modules:
  - .1 Continuous rating: as indicated on the drawings.
  - .2 Internal bypass contactor.
  - .3 Rated operation voltage: 600 Vac, 60 Hz.
  - .4 Control circuit voltage: 120 Vac, 60 Hz.
  - .5 Operating temperature range, without de-rating: -10 to +40°C.
  - .6 Logic inputs: Qty 2, 120 VAC, programmable.
  - .7 Relay outputs: Qty 2, Form C (Normally Open, Normally Closed), 120 VAC
  - .8 Vibration resistance:
    - .1 1.5 mm peak from 2 to 13 Hz
    - .2 1 gn from 13 to 200 Hz
  - .9 Shock resistance: 15 g, 11 ms
  - .10 Acceptable products:
    - .1 Schneider Electric ATS22 Series, or approved equal
- .3 Bypass Contactors:
  - .1 Internal to soft starter
- .4 Control Transformers:
  - .1 Single phase, dry-type, with 600 V primary and 120 V secondary, complete with primary and secondary fusing, installed in enclosure with soft starter, as indicated.
  - .2 Calculate required size of the control transformer. The size shown on the drawings is the minimum size. Provide size as required for appropriate operation of the starter, plus twenty percent (20%) spare capacity.
- .5 Cooling:
  - .1 Provide cooling system as required to maintain an acceptable enclosure.
  - .2 Intake fan located at bottom of enclosure.
  - .3 Exhaust vent located at top of enclosure.
- .6 Door-mounted soft starter Human Interface Module (HIM).
- .7 Pilot Devices:
  - .1 Pushbuttons and selector switches: Heavy-duty, oil tight, NEMA rated, 30 mm, labelled as indicated.
  - .2 Indicating lights: Heavy-duty, oil tight, NEMA rated, 30 mm, LED bulb, type and color as indicated.
  - .3 Start pushbuttons to utilize a green cap, and stop pushbuttons to utilize a red cap.

- .8 Documentation:
  - .1 Provide door pocket with complete set of drawings for each starter.
- .9 Provide control signal interface to existing Metasys Control system.
- .10 Locking in "OFF" position with up to three (3) padlocks.
- .11 Independent locking of enclosure door.
- .12 Provision for preventing switching to "ON" position while enclosure door open.
- .13 Accessories:
  - .1 Two (2) position key switch on P-1 starter door wired to field terminals.

**2.3 FINISHES**

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 – Common Work Results - For Electrical.

**2.4 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - For Electrical.
- .2 Soft starter designation label, black plate, white letters, size 4 engraved as indicated.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.
- .3 Confirm operation of motor starters from Metasys Control System.

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - For 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**