Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises replacement of hydraulic bus lift hoists and structural repairs of the main floor and foundations, located at the Winnipeg Transit Fort Rouge Garage, 412 Osborne Street, Winnipeg and further identified as the Work.

1.2 CONTRACT METHOD

.1 Construct Work under a Purchase Order issued by the City of Winnipeg as outlined in the Bid Opportunity and associated Terms and Conditions.

1.3 REFERENCES AND CODES

.1 Perform Work in accordance with the National Building Code of Canada (NBC) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of contract documents, specifications, as specified standards, codes and referenced documents, latest editions.

1.4 WORK SEQUENCE

.1 Co-ordinate Progress Schedule and co-ordinate Work with the adjacent City Occupancy during construction.

.2 Construct Work in stages to provide for continuous City usage of adjacent hoists. Do not close off usage of facilities without coordination with the City.

.1 The Contractor will not be restricted in the number of hoists being worked on, however work on hoist replacement must proceed more or less continuously, to limit the amount of time they are out of service.

1.5 CONTRACTOR USE OF PREMISES

.1 Limit use of premises for Work, for storage, and for access, to allow:

.1 The City occupancy.
.2 Continuous operation of adjacent areas.

.2 Co-ordinate use of premises under direction of the City and the Contract Administrator.

.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 the Contract Administrator.

.6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.6 THE CITY OCCUPANCY

.1 The City will occupy premises during entire construction period for execution of normal operations.

.2 Co-operate with the City in scheduling operations to minimize conflict and to facilitate City usage.

1.7 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.8 EXISTING SERVICES

.1 Notify the City and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves connecting to existing services, give the City minimum 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions.

.3 Where unknown services or embedded electrical conduit are encountered, immediately advise the Contract Administrator and confirm findings in writing.

.4 Protect, relocate or maintain existing active services.

1.9 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed Shop Drawings.
- .5 Change Orders.
- .6 Other Modifications to Contract.
- .7 Field Test Reports.
- .8 Copy of Approved Work Schedule.
- .9 Health and Safety Plan and Other Safety Related Documents including:
  - .1 Material data sheets (MSDS) on all products used in Project.
- .10 Other documents as specified.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work.

1.2 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, in accordance with relevant municipal, provincial and other regulations.

1.3 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 Where security is reduced by work provide temporary means to maintain security.

.4 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.5 Keep within limits of work and avenues of ingress and egress.

1.4 WORKING HOURS

.1 Working hours for concrete demolition or other work process deemed to be excessively noisy or disruptive will be restricted to between 2:00 p.m. and 7:00 a.m. Monday through Sunday.

.2 Working hours for all other work process will be allowed to take place at all hours of day Monday through Sunday, subject to allowing for continual operation within the premises.

1.5 SPECIAL REQUIREMENTS

.1 All work which interferes with the normal operation of the facility and/or require closures of adjacent bus lifts or work areas will have to be precisely coordinated with the City. The allowable stall closures must not exceed the following:

.2 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.3 Keep within limits of work and avenues of ingress and egress.

1.6 BUILDING SMOKING ENVIRONMENT

.1 Smoking is not allowed.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS

.1 Ensure Schedule is practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

1.2 SUBMITTALS

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

.2 Submit to Contract Administrator Bar (GANTT) Chart for planning, monitoring and reporting of project progress, as per the Bid Opportunity.

1.3 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Contract Administrator will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will be used as baseline for updates.

1.4 PROJECT SCHEDULE

.1 Ensure detailed Project Schedule includes as minimum milestone and activity types as indicated in the Bid Opportunity document.

1.5 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on biweekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.6 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 33 00 – Cast-in-Place Concrete.

1.2 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 are 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 reviewed copy of each submission on site.

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, Canada.

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

.4 Allow 5 working days for Contract Administrator's review of each submission.

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

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

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

.8 Submit electronic copy in PDF format of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.

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

.10 Delete information not applicable to project.

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

.12 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.

1.4 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

.2 Manitoba Regulation 217/2006 – Workplace Safety and Health Regulation.

.4 BID OPPORTUNITY 787-2019.

1.2 SUBMITTALS

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

.2 Submit copies of incident and accident reports.

.3 Submit WHMIS MSDS - Material Safety Data Sheets on all products used in conjunction with the Work.

.4 W.H.I.M.I.S. Training: Provide copies of valid certification/training for all employees (regular or temporary) including all subcontractors.

.1 All individuals involved in the application of any product shall meet all WHIMIS/provincial standards safety/protection requirements at all times.

.5 Upon request submit Letter of Good Standing or C.O.R. Certificate.

1.3 GENERAL REQUIREMENTS

.1 Contractors to be C.O.R. Registered or C.O.R. Certified. Refer to the Bid Opportunity for further requirements.

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

1.4 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.

1.5 PERSONAL PROTECTIVE EQUIPMENT (PPE)

.1 All employees (regular or temporary) of contractor and subcontractors shall wear PPE in accordance with Manitoba Regulation 217/2006.

.2 Fall Protection: Provide fall protection in accordance with Manitoba Regulation 217/2006.

1.6 EMBEDDED ELECTRICAL CONDUIT

.1 When the presence of embedded electrical conduits are known:

.1 Prior to demolition ensure circuits feeding conduit within repair areas are disconnected, de-energized, or abandon.

.2 Coordinate shutdowns with the City.

.2 When the presence of embedded electrical conduits is unknown or are known but locations cannot be determined:

.1 Prior to demolition of concrete repairs, scan existing concrete structures for embedded electrical conduit.

.2 Ensure circuits feeding conduit within repair areas are disconnected, de-energized, or abandon.

.3 Coordinate shutdowns with the City.

.4 Costs of scanning to be paid for via the testing cash allowance.

1.7 WORK STOPPAGE

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 21 00 – Allowances.

1.2 REFERENCES

.1 Bid Opportunity 787-2019.

1.3 INSPECTION

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

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

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

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

1.4 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged for purpose of inspecting and/or testing portions of Work. Cost of such services will be paid by the Contractor as part of performing the work.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Contract Administrator at no cost to The City. Pay costs for retesting and reinspection.

1.5 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work.

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

1.6 PROCEDURES

.1 Notify appropriate agency in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 REJECTED WORK

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

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

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

1.8 REPORTS

.1 Submit copies of inspection and test reports to The City and Contract Administrator.

.2 Provide copies to subcontractor of work being inspected or tested [manufacturer or fabricator of material being inspected or tested].

.3 Provide copies of concrete test results to Concrete Supplier.

1.9 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

1.10 MILL TESTS

.1 Submit mill test certificates as [requested] [required of specification Sections].

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.2 WATER SUPPLY

.1 The City will make available, for the extent that it is available, a supply of potable water for construction use at no charge to the Contractor

.2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.

.3 The Contractor shall provide all necessary hoses, lines, connections, and other ancillary hardware which may be required.

.4 The services are to be returned to their original condition at the temporary locations, or left in an altered condition only as approved by the City.

1.3 TEMPORARY HEATING AND VENTILATION

.1 Ventilating:

.1 Work will take place near mechanical equipment sensitive to dust. Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.2 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.3 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.4 TEMPORARY POWER AND LIGHT

.1 The City will make available and pay for, for the extent that it is available temporary power during construction for temporary lighting and operating of power tools to a maximum supply of 120 volts.

.2 Connect to existing power supply in accordance with Canadian Electrical Code.

.3 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

.4 Temporary power for equipment requiring in excess of that available on-site is responsibility of the Contractor.

.5 Provide and maintain temporary lighting throughout project as required.

1.5 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Bid Opportunity 787-2019.

.2 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA O121-08, Douglas Fir Plywood.

1.2 SUBMITTALS

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

1.3 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.

1.4 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not interfere with normal operations, access by the City, or disrupt performance of Work.

1.5 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.

1.6 SANITARY FACILITIES

.1 The Contractor may use on-site facilities for the duration of the project. The facilities must be maintained in a neat condition or use will be revoked.

1.7 POLLUTION CONTROL

.1 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures and/or other control methods. Dust can trigger fire alarm smoke detectors and can plug ducts and filters. Dust and suspended particles can damage mechanical and electrical equipment. Contractor shall be responsible for all damages. Prior to start of work, identify locations of air intakes and air-cooled mechanical and electrical equipment within and adjacent to the area of work.

.2 Control noxious and hazardous gases. Prevent hazardous accumulations. Control emission from equipment and plant to local authority's emission requirements.

1.8 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 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 The Contractor must barricade off the area under construction to prevent the City personnel from improper access to the construction area.

.2 Repair surface coatings and/or finishes which are damaged by temporary hoardings and barricades.

.3 Provide adequate signage, fencing, etc. to inform the City of the work being undertaken.

1.3 DUST TIGHT SCREENS

.1 Provide dust tight enclosures to localize dust generating activities, and for protection of workers, finished areas of Work and the City operations.

.2 Maintain and relocate protection until such work is complete.

1.4 FIRE ROUTES

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

1.5 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.

1.6 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 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Bid Opportunity 787-2019.

.2 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.

.3 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

.4 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.

.5 The Cost for such testing will be borne by the Contractor or Supplier.

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 in 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 Contract Administrator.

.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. Where conflicts exist, the more stringent instruction will be enforced.

.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 REMEDIAL WORK

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

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.10 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.

1.11 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.

.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

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Bid Opportunity 787-2019.

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by The City or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site.

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

.4 Provide on-site containers for collection of waste materials and debris.

.5 Dispose of waste materials and debris off site.

.6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.

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

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

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

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

1.3 FINAL CLEANING

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

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

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

.4 Remove waste products and debris other than that caused by The City or other Contractors.

.5 Remove waste materials from site at regularly scheduled times. Do not burn waste materials on site.

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

.7 Remove stains, spots, marks and dirt from existing surfaces, fixtures, and finishes within the work area or affected by the affected by the Work.

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

.9 Remove dirt and other disfiguration from exterior surfaces.

.10 Sweep and power wash clean all work areas.

.11 Remove construction debris from drain and pits..

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Bid Opportunity 787-2019.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

- .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1 Notify Contract Administrator in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
  - .2 Request Contract Administrator's inspection.
- .2 Contract Administrator's Inspection:
  - .1 Contract Administrator and Contractor to inspect Work and identify defects and deficiencies.
  - .2 Contractor to correct Work as directed.
- .3 Completion Tasks: submit written certificates that tasks have been performed as follows:
  - .1 Work: completed and inspected for compliance with Contract Documents.
  - .2 Defects: corrected and deficiencies completed.
  - .3 Work: complete and ready for final inspection.
- .4 Final Inspection:
  - .1 When completion tasks are done, request final inspection of Work by Contract Administrator, and Contractor.
  - .2 When Work incomplete according to Contract Administrator, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Performance: when Contract Administrator considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
- .6 Commencement of Lien and Warranty Periods: date of The City's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .7 Final Payment:
  - .1 When Contract Administrator considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
  - .2 Refer to Bid Opportunity: when Work deemed incomplete by Contract Administrator, complete outstanding items and request re-inspection.
- .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.3 FINAL CLEANING

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Operation and maintenance data.

.2 As-built drawings, samples, and specifications.

.3 Product data, materials and finishes, and related information.

.4 Record documents.

.5 Equipment and systems.

.6 Spare parts, special tools and maintenance materials.

.7 Warranties and bonds.

1.2 RELATED SECTIONS

.1 Section 41 22 23.23 – In-Ground Hoists

1.3 SUBMISSION

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Copy will be returned after final inspection with Contract Administrator's comments.

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

.4 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, five final copies of operating and maintenance manuals in English.

.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.6 If requested, furnish evidence as to type, source and quality of products provided.

.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.8 Pay costs of transportation.

1.4 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by Systems under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.5 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 date of submission;

.2 names, addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties; and

.3 schedule of products and systems, indexed to content of volume.

.2 For each product or system, list names, addresses and telephone numbers of Subcontractors and Suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

.6 Certificates of Acceptance: relevant certificates issued by authorities having jurisdiction, including code compliance certificate.

1.6 AS-BUILT DOCUMENTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Contract Administrator one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to the Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label as-built documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.

.4 Maintain as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.

.5 Keep as-built documents and samples available for inspection by Contract Administrator.

1.7 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and in a copy of the Project Manual, provided by Contract Administrator.

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

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

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

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

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

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

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

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

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

.2 Changes made by Addenda and change orders.

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

1.8 RECORD DOCUMENTS

.1 Prior to Substantial Performance of the Work, provide the marked up as-built documents to the Contract Administrator.

1.9 EQUIPMENT AND SYSTEMS

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

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

.3 Include installed colour coded wiring diagrams.

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

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

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

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

.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control .

.15 Additional requirements: As specified in individual specification sections.

1.10 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Additional Requirements: as specified in individual specifications sections.

1.11 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to a location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered Products and submit prior to final payment.

1.12 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to a location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered Products and submit prior to final payment.

1.13 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to a location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

1.14 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged Products at own expense and to satisfaction of Contract Administrator.

1.15 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List Subcontractor, Supplier, and manufacturer, with name, address, and telephone number of responsible principals.

.3 Obtain warranties and bonds, executed in duplicate by Subcontractors, Suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.

.4 Except for items put into use with The City's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

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

.6 Co-execute submittals when required.

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

END OF SECTION

Part 1 General

.1 This section specifies requirements for demolishing, salvaging and removing wholly or in part, various items designated to be removed or partially removed to facilitate repairs to the parkade. Disposal of debris generated from the work as well as protection of items designated to remain are also covered under this section

1.2 SECTION INCLUDES

.1 Methods and procedures for deconstruction of structures and parts of structures.

1.3 RELATED SECTIONS

1.4 REFERENCES

.1 Reference Standards:

.1 Canadian Standards Association (CSA International)

.1 CSA S350-[M1980(R2003)], Code of Practice for Safety in Demolition of Structures.

.2 National Building Code 2010, Part 8 - Safety Measures at Construction and Demolition Sites

1.5 MEASUREMENT PROCEDURE

.1 No measurement will be made under this section. Include costs in item of work for which demolishing is required.

1.6 SUBMITTALS

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

1.7 SITE CONDITIONS

.1 Existing Conditions:

.1 The work will be carried out in phases. While the work is in progress in a single phase active operations must continue in the other phases in upper and lower decks throughout the repair program. Site protection to occupied areas above and below the deck are therefore paramount, particularly during the demolition phase.

.2 Vehicle and barrier free access to the building entrances and exits must be maintained at all times during the course of the work.

.3 The City must be given a minimum seven days advance notice prior to commencement of repairs.

.2 Protection:

.4 Protect existing structures and services designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Contract Administrator and at no cost to The City.

.5 In all circumstances ensure that demolition work does not adversely affect adjacent areas and operations below the parking deck.

.6 Do not dispose of waste of volatile materials such as, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout the project.

.7 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.

.8 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.

.9 Prevent movement, settlement or damage of adjacent structures, services. Provide bracing, shoring as required. Repair damage caused by deconstruction as directed by Contract Administrator.

.10 Support affected structures and, if safety of structure being deconstructed [or] adjacent structures appears to be endangered, take preventative measures. Cease operations and immediately notify Contract Administrator.

.11 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems.

Part 2 Products

2.1 EQUIPMENT

.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

.2 Where possible use water efficient wetting equipment/attachments when minimizing dust.

.3 Protect existing items designated to remain and materials designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Contract Administrator and at no cost to The City.

.4 Demonstrate that tools are being used in manner which allows for salvage of materials in best condition possible.

.5 Locate and protect any utility lines which may be affected by the work and if necessary, notify utility companies before starting demolition.

.6 The parking deck has a structural live load capacity of 50 pounds per square foot; thus, equipment and stockpiling of material must not exceed this limit.

Part 3 Execution

3.1 SITE VERIFICATION OF CONDITIONS

3.2 DISASSEMBLY

.1 Conduct demolition to minimize interference with adjacent building areas maintain protected, wheelchair accessible egress and access at all times to the building entrance.

.2 All debris created by the execution of the work shall be removed progressively from the site to appropriate disposal grounds. Do not damage adjacent finishes or surfaces.

.3 Do not disturb adjacent items designated to remain in place.

.4 Carefully remove and store reusable site materials and dismantle items containing materials for salvage and stockpile salvaged materials at locations as approved by the Contract Administrator.

.5 Ensure workers and subcontractors are briefed and trained to carry out work in accordance with appropriate deconstruction techniques.

.6 Project supervisor with previous deconstruction experience must be present on site throughout project.

.7 Deconstruct in accordance with CSA S350 and other applicable safety standards.

3.3 REMOVAL FROM SITE

.1 Transport material designated for disposal to approved facilities in accordance with applicable regulations.

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

3.4 CLEANING AND RESTORATION

.1 Keep site clean and organized throughout deconstruction.

.2 Upon completion of project, remove debris, trim surfaces and leave work site clean.

.3 Upon completion of project, reinstate parking surfaces, walkways, affected by Work to condition which existed prior to beginning of Work and match condition of adjacent, undisturbed areas.

.4 In addition to the progressive removal of waste materials and debris from building and site, leave the site clean, perform the following before final inspection by the Contract Administrator.

- .1 spray-wash all exterior building finishes in construction area and any adjacent building areas soiled by the construction processes.
- .2 Broom clean and wash exterior walks, steps and platforms soiled from delivery or removal materials.
- .3 Remove all dirt and other disfigurations from exterior surfaces.
- .4 Sweep clean all paved areas.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1-09/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-O86-14, Engineering Design in Wood.

.3 CSA O121-08, Douglas Fir Plywood.

.4 CSA O151-09, Canadian Softwood Plywood.

.5 CSA O153-13, Poplar Plywood.

.6 CAN/CSA-O325-07, Construction Sheathing.

.7 CSA S269.1-13, Falsework and Formwork.

1.3 MEASUREMENT PROCEDURES

.1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

1.4 SUBMITTALS

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

.2 Submit shop drawings for formwork and falsework.

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

.3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

.4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, and CSA-O153.

.2 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.3 Form liner:

.1 Plywood: medium/high density overlay.

.4 Form release agent: non-toxic, biodegradable, low VOC.

.5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.

.6 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Fabricate and erect falsework in accordance with CSA S269.1.

.2 Refer to drawings for concrete members requiring architectural exposed finishes.

.3 Do not place shores and mud sills on frozen ground.

.4 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.5 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.6 Align form joints and make watertight. Keep form joints to minimum.

.7 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.

.8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Construct forms for architectural concrete, and place ties as indicated and as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.12 Line forms for following surfaces:

.1 Surfaces designated as architectural finish.
.2 Secure lining taut to formwork to prevent folds.
.3 Pull down lining over edges of formwork panels.
.4 Ensure lining is new and not reused material.
.5 Ensure lining is dry and free of oil when concrete is poured.
.6 Application of form release agents on formwork surface is prohibited where drainage lining is used.
.7 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
.8 Cost of textile lining is included in price of concrete for corresponding portion of Work.

.13 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Notify Contract Administrator 24 hours in advance prior to removing formwork.

.2 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, design loads that are liable to be imposed upon it. Verify strength of concrete by compressive test results.

.3 Leave formwork in place for following minimum periods of time after placing concrete:

LOCATION	TEMPERATURE IN °C		
	21-35	15-21	10-15
Walls	2 days	3 days	4 days
Grade Beams	2 days	3 days	4 days
Side Forms	2 days	3 days	4 days
Slabs *	7 days	7 days	14 days
Beams *	7 days	7 days	14 days
Structural Shoring *	7 days	7 days	14 days

* formwork below/supporting these elements shall remain in place for the minimums stated above and then replaced with shoring posts until concrete is 28 days old. Formwork can be removed and replaced with shoring posts earlier, if concrete test cylinders show a strength of 75% of the required 28-day strength.

.4 Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.

.5 Remove formwork progressively and in accordance with Building and Safety Code requirements and so that no shock loads or unbalanced loads are imposed on structure.

.6 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.

.7 Store removed forms, for exposed concrete, so surfaces in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.

.8 Re-use formwork subject to requirements of CAN/CSA-A23.1.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 10 00 – Concrete Forming and Accessories.

.2 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1-09/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.

.3 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.4 CAN/CSA-G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.

.5 CSA W186-09(R2014), Welding of Reinforcing Bars in Reinforced Concrete Construction.

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

.1 ASTM A82-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 ASTM A775/A775M-17, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.3 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 MEASUREMENT PROCEDURES

.1 Reinforcing steel will be measured in kilograms of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA G30.18 for lengths and sizes of bars as indicated.

.2 No measurement will be made under this Section.

.1 Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

1.4 SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Submit shop drawings including placing of reinforcement and indicate:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

.1 Provide class B tension lap splices unless otherwise indicated.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Contract Administrator.

.2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.

.3 Cold drawn annealed steel wire ties: to ASTM A82.

.4 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only.

.5 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.

.6 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m^2.

.7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.8 Mechanical splices: subject to approval of Contract Administrator.

.9 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 All reinforcing is to be detailed in accordance with the latest edition of the Reinforcing Steel Institute of Canada - Manual of Standard Practice, except otherwise noted

.3 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.

.4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.

.5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request inform Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Use plain round bars as slip dowels in concrete where noted on the drawings.

.1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.2 When paint is dry, apply thick even film of mineral lubricating grease.

.3 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.

.4 Ensure cover to reinforcement is maintained during concrete pour.

.5 Protect epoxy coated portions of bars with covering during transportation and handling.

3.3 DOWELING PROCEDURES

.1 For bars that are indicated as being dowelled in, drill in and epoxy grout bars as follows:

.1 10M bars, 200 mm

.2 15M bars, 250 mm

.3 20M bars, 350 mm

.4 25M bars, 400 mm

.2 Use only approved adhesive to manufacturer's instructions. Acceptable product:

.1 Hilti HIT HY-200 by Hilti Canada.

.3 Clean hole thoroughly prior to application of epoxy. Use injection or caulking gun to ensure that the epoxy fills the bottom of the hole prior to embedment of bar.

3.4 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 10 00 – Concrete Forming and Accessories.

.2 Section 03 20 00 – Concrete Reinforcing.

.3 Section 31 63 23 – Bored Piles.

1.2 REFERENCES

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

.1 ASTM C260/C250M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C330/C330M-14, Standard Specification for Lightweight Aggregates for Structural Concrete.

.4 ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete.

.5 ASTM C1017/C1017M-13, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.6 ASTM D412-06a(2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.7 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.8 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

.9 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283-06(R2011), Qualification Code for Concrete Testing Laboratories.

.3 CAN/CSA-A3000-13, Cementitious Materials.

.4 International Concrete Repair Institute (ICRI)

.1 ICRI Guideline No. 310.2R-2013, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.3 SUBMITTALS

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

.2 Certificates:

.1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

.2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

.3 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.4 Concrete hauling time: submit for review by Contract Administrator deviations exceeding maximum allowable time of 120 for concrete to be delivered to site of Work and discharged after batching.

1.4 QUALITY ASSURANCE

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

.2 Submit to Contract Administrator, minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.

.3 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on following items:

.1 Falsework erection.
.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.
.5 Finishes.
.6 Formwork removal.
.7 Joints.

.4 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Contract Administrator, verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to by Contract Administrator and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Contract Administrator.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 MATERIALS

.1 The concrete constituents shall comply with the following standards:

.1 Cement: to CAN/CSA-A3001.

.2 Blended hydraulic cement: to CAN/CSA-A3001.

.3 Supplementary cementing materials: with minimum 20% Type F fly ash replacement by mass of total cementitious materials to CAN/CSA-A3001.

.4 Water: to CSA-A23.1.

.5 Aggregates: to CAN/CSA-A23.1/A23.2.

.6 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494 and ASTM C1017. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.2 CONCRETE MIX REQUIREMENTS

.1 Refer to General Notes on Drawings for concrete mix requirements.

2.3 ACCESSORIES

.1 Evaporation retardant: Acceptable Product:

.1 MasterKure ER 50, formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):

.1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.

.2 MasterKure CC, formerly (Kure-N-Seal) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.3 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34 unless otherwise noted on Drawings.

.4 Non premixed dry pack grout: composition of non metallic aggregate Type GU cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 25 MPa at 28 days.

.5 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.2 Sponge rubber: to ASTM D1752, Type I, firm grade.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Contract Administrator approval before placing concrete.

.1 Provide minimum 24 hours notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Ensure reinforcement and inserts are not disturbed during concrete placement.

.5 Protect previous Work from staining.

.6 Clean and remove stains prior to application for concrete finishes.

.7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.8 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with chemical grout to anchor and hold dowels in positions as indicated.

.9 Do not place load upon new concrete until authorized by Contract Administrator.

3.2 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by the Contract Administrator.

.2 Where approved by the Contract Administrator, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by the Contract Administrator.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Contract Administrator before placing of concrete.

.5 Check locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.3 Anchor bolts:

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 With approval of the Contract Administrator, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to manufacturers' recommendations.

.3 Protect anchor bolt holes from water accumulations.

.4 Set bolts and fill holes with shrinkage compensating grout or chemical grout.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.4 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.5 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

.6 Finishing:

.1 Finish concrete in accordance with CSA-A23.1/A23.2.

.1 Concrete tolerance in accordance with CSA-A23.1/A23.2.

.2 Finish type: light broom finish.

.2 Use curing methods compatible with applied finish on concrete surfaces.

.7 Curing:

.1 Cure and protect concrete in accordance with requirements CSA A23.1.

.2 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. See General Notes on structural drawing for Class of Exposure.

.8 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Contract Administrator.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form construction and expansion joints as indicated.

.4 Install joint filler.

.5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

3.3 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by the Contract Administrator for review in accordance with CSA-A23.1/A23.2.

.1 Ensure testing laboratory is certified in accordance with CSA A283.

.2 Frequency and Number of Tests:

.1 Concrete Tests:

.1 Not less than one strength test per 50 cubic metres of concrete placed and not less than one test for each class of concrete placed on any one day.

.2 Air measurements will be completed on each of the initial 3 loads of concrete per day of casting to ensure satisfactory control of the air content is established. If adequate control of air content is not established within the first 3 loads of concrete or if a test falls outside the specified limits, the testing frequency shall revert to one test per load until satisfactory control is re-established. Costs for additional testing will be the responsibility of the concrete supplier.

.3 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve Contractor of their contractual responsibility.

3.4 DEFECTIVE CONCRETE

.1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.

.2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.

.3 Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.

.4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.

.5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.

.6 Notify Contract Administrator of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Contract Administrator.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section covers the removal of deteriorated concrete and surface preparation for the repair of deteriorated concrete resulting from reinforcing steel corrosion and is applicable to horizontal, vertical, and overhead repairs.

.2 The care that is exercised during the removal and preparation phases of concrete repairs can be the most important factor in determining the longevity of the repair, regardless of the material or technique used.

.3 All delaminated or deteriorated concrete must be removed down to sound concrete. The reinforcing may have to be exposed at these locations by removing additional concrete, if there is any sign of corrosion. All concrete and exposed reinforcing shall be cleaned of all corrosion by mechanical means.

1.2 RELATED SECTIONS

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 92 11 – Top Surface Repairs.

.3 Section 03 92 20 – Scaling Repairs.

1.3 REFERENCES

.1 American Concrete Institute (ACI)

- .1 ACI 546-04, Concrete Repair Guide.
- .2 ACI RAP-5, Surface Repair Using Form-and-Pump Techniques.
- .3 ACI RAP-7, Spall Repair of Horizontal Concrete Surfaces.
- .4 ACI RAP-3, Spall Repair by Low-Pressure Spraying.
- .5 ACI RAP-4, Surface Repair Using Form-and-Pour Techniques.
- .6 ACI RAP-6, Vertical and Overhead Spall Repair by Hand Application.
- .7 ACI RAP-9, Spall Repair by the Preplaced Aggregate Method.

.2 Canadian Standards Association (CSA)

- .1 CSA- S448.1-10, Repair of Reinforced Concrete in Buildings.

.3 International Concrete Repair Institute (ICRI)

- .1 ICRI concrete Repair Terminology (2010 Edition).
- .2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.
- .3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).
- .4 ICRI Guideline No. 310.1R–2008, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion (formerly No. 03730).

.5 ICRI Guideline No. 310.2–1997, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays (formerly No. 03732).

1.4 MEASUREMENT PROCEDURES

.1 No measurements will be made under this Section. Refer to applicable Sections for measurement procedures for each type of repair.

1.5 DEFINITIONS

.1 Delamination: A separation along a plane parallel to a surface as in the separation of a coating from a substrate or the layers of a coating from each other, or in the case of a concrete slab, a horizontal splitting, cracking, or separation of a slab in a plane roughly parallel to, and generally near, the upper surface.

.2 Laitance: A weak layer of cement and aggregate fines on a concrete surface that is usually caused by an overwet mixture, overworking the mixture or excessive finishing, underwater concrete placement, or combinations thereof.

.3 Sounding: A technique to evaluate the condition of hardened concrete by striking the surface with a hammer; sound concrete will exhibit a clear ringing sound, whereas dull or hollow sounds indicate delaminated areas.

.4 Spall: A fragment, usually in the shape of a flake, detached from a larger mass by a blow, by the action of weather, by pressure, or by expansion within the larger mass; a small spall involves a roughly circular depression not greater than 120 mm in depth and 150 mm in any dimension; a large spall, may be roughly circular or oval or in some cases elongated, is more than 20 mm in depth and 150 mm in greatest dimension

.5 Substrate: The layer immediately under a layer of different material to which it is typically bonded; an existing concrete surface that receives an overlay, partial-depth repair, protective coating, or some other maintenance or repair procedure.

.6 Surface Preparation: The process whereby a method or combination of methods is used to remove deteriorated or contaminated concrete and roughen and clean a substrate to enhance bond of a repair material or protective coating.

.7 Surface Profile: The topographic contour of the exposed surface of a material or substrate.

1.6 QUALITY ASSURANCE

.1 Contractor Qualifications:

.1 Minimum of 5 years' experience in the repair and restoration of concrete structures.

.2 Provide minimum 5 examples of local projects demonstrating successful performance concrete repairs of similar size and complexity to specified Work within the last 3 years upon request.

.3 Site Superintendent to have a minimum of 5 years' experience exhibiting successful performance in concrete restoration projects. Provide references upon request.

.4 Ensure all personnel involved with concrete restoration is adequately trained and familiar with the requirements of this Section.

.2 Field Mock-ups (Upon Contract Administrator Request):

.1 Complete a field mock-up for each type of repair and surface preparation implemented as requested by Contract Administrator. Locations to be Site determined.

.2 Field mock-up shall be a minimum of 2 sq.ft. and incorporate all aspects of the concrete surface preparation described in this Section. Trial repairs areas shall be chosen to include exposure of embedded reinforcing steel.

.3 Field mock-up areas shall be used as a standard against which subsequent work shall be judged.

Part 2 Products

2.1 EQUIPMENT

.1 Electric or pneumatic chipping hammers are to be used for demolition within the following limits:

.1 Initial bulk removal of delaminated concrete above corroded reinforcing steel: maximum 30 lb. electric or pneumatic chipping hammers.

.2 Final removal and undercutting of reinforcing steel: maximum 15 lb. electric chipping hammers.

.1 All surface preparation of slab on grade perimeters previously saw cut, to be completed with maximum 15 lb. electric chipping hammers.

.3 Bulk removal of full depth repairs: electric or pneumatic jack hammers with weight ratings above 30 lbs. may be used upon approval by Contract Administrator.

.4 Only flat-chisel type blades are to be used for removal. Do not use pointed chisels for removal.

.2 Sandblast equipment shall consist of:

.1 Air compressor of sufficient capacity to drive the equipment and blast media selected.

.2 Blast media hopper (meters the media into the air stream passing through the hose and nozzle).

.3 Moisture and oil separators to insure clean, dry air supply.

.4 Blast nozzle and hose.

.5 Materials. The blast medium consistent with equipment, Site conditions, and capable of obtaining specified surface profile.

Part 3 Execution

3.1 EXAMINATION

.1 The location number and extent of repairs shown on Drawings are indicative only. Repairs areas will be identified on-Site by the Contract Administrator in the presence of and with the assistance of the Contractor. The approximately periphery of the repair will be marked on the surface of the member and the location and extent recorded on drawings.

.2 Allow time in the Schedule for survey and inspection work carried out by the Contract Administrator ahead of repairs. Provide sufficient safe access to enable review of all areas designated for repairs.

.3 The Contractor shall make available as required throughout the Contract labour to carry out the following under the direction of Contract Administrator:

.1 Identification of repairs.

.2 Sample chipping and/or drilling.

.3 Operators for access equipment.

.4 The Contractor shall make available as required throughout the Contract equipment for the use of the Contract Administrator:

.1 Marking paint and chalk.

.2 Hammer and chain for sounding surveys.

.3 Tape measure.

3.2 PREPARATION

.1 All necessary measures shall be taken to provide protection to the general public, occupants of the building.

.2 Remove or protect all surface attachments (e.g. signs, notices, electrical fittings) from the areas to be repaired or from positions that obstruct access or which may be damaged from Work.

.3 Carefully store items removed during the course of the works. Reinstall when restoration work is complete.

.4 The Contractor shall make good or rectify any damage caused as a result of insufficient protection.

.5 Provide temporary access required to facilitate Work.

3.3 CONCRETE DELAMINATION REMOVAL

.1 Refer also to Figure 1 in this Section.

.2 Remove all loose and or delaminated concrete above corroded reinforcing steel.

.3 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.

.4 Use chipping to extend concrete removal along reinforcing bars and ensure bars are completely free of corrosion and well bonded to the surrounding concrete. Notify Contract Administrator of increases in areas.

.5 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused more than 1/3 the periphery of a bar to be exposed for a distance of 6 inches (150 mm) or more, the concrete adjacent to the bar shall be removed by maximum 15 lb. electric chipping hammers to provide sufficient clearance between the reinforcement and concrete.

.1 Provide a minimum 3/4 inches (20 mm) clearance, or 1/4 inch (6 mm) larger than the largest aggregate in the repair material, whichever is greater.

.6 If non-corroded reinforcing steel is exposed, do not damage the bar's bond to the surrounding concrete. If bond between the bar and concrete is destroyed, exposing the bar will be required.

.7 The perimeter of the areas marked as delaminated are to be saw cut. Feather edging is not permitted. If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly.

.8 Ensure the entire area within the saw cut is removed to a depth consistent with the type of repair and repair material specified in other Sections.

.9 Chip patch edges to provide a clean vertical edge along the patch perimeter to the required minimum depth.

.10 Conduct soundings to determine if any further unsound or delaminated concrete is present, which must be removed.

3.4 SURFACE PREPARATION OF CONCRETE AND REINFORCING STEEL

.1 Refer also to Figure 1 in this Section.

.2 Within 24 hours prior to infilling, wire brush and vacuum, sandblast, or high pressure waterblast at a minimum 4,000 psi the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete.

.3 Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.

.4 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.

.5 Exposed reinforcing steel to be cleaned to near white metal and free of rust for the full circumference of the bar.

.6 Secure any reinforcement which is loose by tying to other secured bars or by other methods approved by Contract Administrator.

.7 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.

.8 Maintain substrate in a clean condition using polyethylene film until the patch material is ready to be placed.

.9 After all surface preparation is complete the Contractor shall request an inspection from the Contract Administrator to review the existing reinforcing steel.

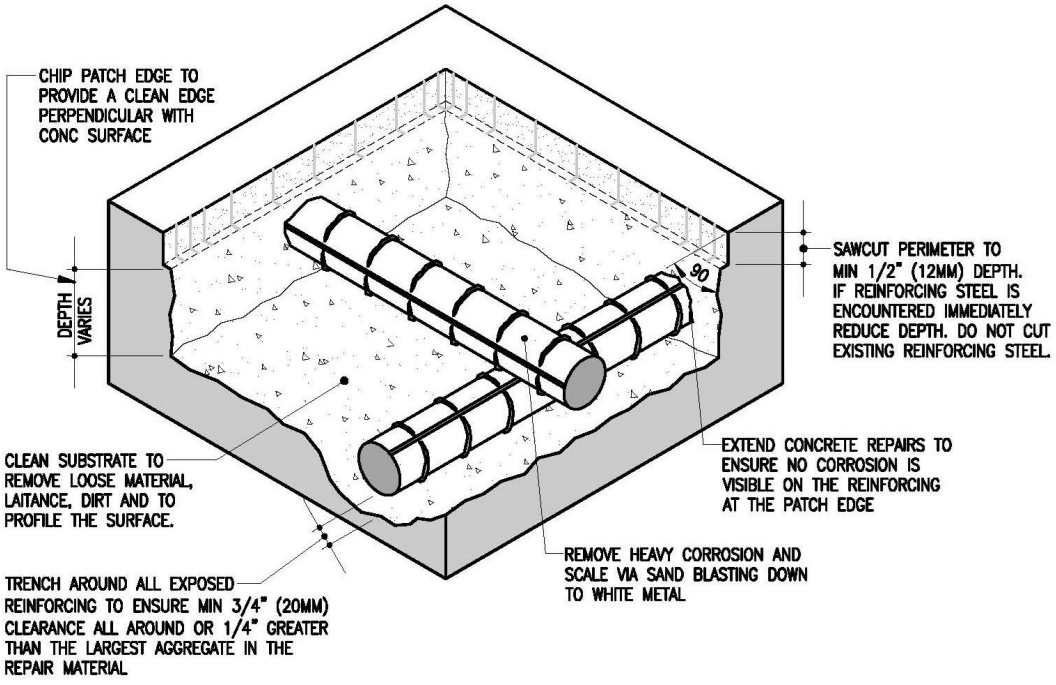
.1 The purpose of this inspection is to provide assurance that all heavy corrosion and scale is removed from the bar. At that time, the Contract Administrator will review the condition of the reinforcing steel and determine if the addition of supplemental reinforcing steel will be required.

.2 At locations identified by the Contract Administrator, provide supplemental reinforcing steel to Section 03 20 00.

.3 Additionally this inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound. If any further Work is required, the Contractor is to complete it immediately.

.10 Maintain substrate in a saturated condition for a period of not less than 4 hours prior to infilling. Do not allow the concrete surface to dry. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.

Figure 1: Surface Preparation for Concrete Delamination Repair



3.5 FIELD QUALITY CONTROL

.1 Coordinate Site work and inspections with Contract Administrator. Provide minimum 24 hours notice.

.2 Contract Administrator inspection of surface preparation to be completed at the following times:

.1 Prior to demolition to identify and quantify repair locations and types.

.2 Following initial demolition to confirm all loose, deteriorated, or unsound concrete has been removed from the substrate.

.3 Following concrete substrate preparation to review concrete surface profile and condition of reinforcing steel.

.1 Contract Administrator to complete inspection of substrate preparation and condition of reinforcing steel prior to infill of all delamination repair areas.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

.1 Provide labour, material, equipment and services necessary for and incidental to the supply and installation of the systems shown on the drawings and hereinafter specified.

.2 Generally this shall include:
- .1 Compressed Air Piping System

Part 2 Products

2.1 PIPE, FITTINGS AND ACCESSORIES

.1 Compressed Air Systems
- .1 Pipe
  - .1 Schedule 40 carbon steel, continuous weld or electric resistance weld pipe conforming to ASTM A53 Grade B.
- .2 Fittings
  - .1 Screwed fittings - 1034 kPa (150 psi) black malleable iron, banded.
  - .2 Unions - 1034 kPa (150 psi) brass to iron seat.
- .3 Equipment
  - .1 Wilkerson, or approved substitute in accordance with clause B7, 3 unit combination particulate, coalescing and regulator c/w gauge to hoist manufacturers equipment.
- .4 Ball Valves
  - .1 MAS B Series, or approved substitute in accordance with clause B7, 3 forged brass ball valves, NPT ends, lever handle, Class 150, 600 WOG.

Part 3 Execution

3.1 GENERAL COMPRESSED AIR PIPING INSTALLATION

.1 Install in accordance with Local Authority Having Jurisdiction.

.2 Connect to equipment/accessories and install in accordance with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.3 Do not bury pipe except where specifically noted on drawings.

.4 Cut all pipe accurately to measurements taken at site, installed without springing or forcing. All changes in direction made with fittings.

.5 Provide unions on all connections to equipment.

.6 Affix applicable labels c/w directional arrows.

.7 Route all piping in accessible pipe spaces in such a way that it does not interfere with free access into pipe space.

.8 Co-operate with all sub-trades to properly locate all equipment connections.

.9 Make threaded joints in steel piping in accordance with ASME B1.20.1. Apply approved non-toxic joint compound to male threads only. Do not apply joint compound to the first two threads. Avoid squeezing excess compound into pipes. Ream and file all pipes. Leave full bore, clean and free of scale.

.10 Piping shall be arranged to drain to low points. Provide dirt pocket drain valves low points. All service connections to come off top of main.

.11 Connect to fixed equipment where noted on drawings or specified herein.

.12 Where necessary, provide and install Unistrut supports fastened to existing structure for anchoring of pipe and accessories.

3.2 EXPANSION AND CONTRACTION OF PIPING

.1 Make provision for expansion and contraction of piping. Use swing connections where necessary.

3.3 TESTING

.1 General:
- .1 Perform operating tests to all systems and equipment in accordance with local regulations and manufacturer's instructions.
- .2 Give 48 hours notice to Contract Administrator in advance of all tests.
- .3 Provide test report to Contract Administrator.
- .4 Include test reports in Operating and Maintenance Manuals

.2 Compressed air piping:
- .1 Test with air at working pressure plus 345 kPa (50 psi)
- .2 Maintain pressure without loss for 2 hours.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 01.

.2 All Drawings and all sections of the Specifications shall apply to and form an integral part of this section.

.3 Carefully examine all plans and Specifications pertaining to this Contract and become familiar with all details. Visit the Site and determine all factors affecting this section of the Work and include all costs for same in Bid Opportunity.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 American National Standards Institute/ International Electrical Testing Association (ANSI/NETA)

.1 ANSI/NETA Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

.3 The electrical installation shall comply with the requirements of the Electrical Supply Authority, the latest edition of the Canadian Electrical Code, with all Provincial and Municipal Laws, Rules and Ordinances, and to the satisfaction of those persons having jurisdiction over same.

.4 Notify the Contract Administrator of any discrepancies or conflictions with any regulation seven (7) working days before Bid Opportunity closes. Failing such notification, meet all such requirements without change to the Contract price.

.5 In no instance shall the standard established by these Specifications and Drawings be reduced by any of the codes, rules or ordinances.

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

1.3 REQUEST FOR INTERPRETATION PROCESS

.1 General:

.1 Immediately on discovery of the need for interpretation of the Contract Documents, Contractor shall prepare and submit an RFI to the Contract Administrator in the form specified.

.2 Contract Administrator will return RFIs submitted to Contract Administrator by other entities controlled by Contractor with no response. The RFI will then be considered closed.

.3 Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's Work or Work of Subcontractors.

.4 For RFIs submitted electronically, include project name and RFI number in subject line of email.

.2 Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

.1 Project name (including building number).

.2 Project number.

.3 Date.

.4 Name of Contractor.

.5 Name of Contract Administrator.

.6 RFI number, numbered sequentially. (eg: RFI-001)

.7 RFI subject.

.8 Specification Section number, title and related paragraphs, as appropriate.

.9 Drawing number and detail references, as appropriate.

.10 Field dimensions and conditions, as appropriate.

.11 Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Price, Contractor shall state impact in the RFI.

.12 Contractor's signature.

.13 Attachments: Include sketches, descriptions, measurements, photos, product data, Shop Drawings, coordination Drawings, and other information necessary to fully describe items needing interpretation.

.1 Include dimensions, thicknesses, structural grid references, and details of affected Materials, assemblies, and attachments on attached sketches.

.3 RFI Forms: Contractor generated form including all content indicated in this Section.

.1 Form and attachments shall be electronic files in Adobe Acrobat PDF format.

.4 Contract Administrator's Action: Contract Administrator will review each RFI, determine action required, and respond. Allow 10 working days for Contract Administrator's response for each RFI. RFIs received by Contract Administrator after 1:00 p.m. will be considered as received the following working day.

.1 The following Contractor-generated RFIs will be returned without action:

.1 Requests for approval of submittals.

.2 Requests for approval of substitutions.

.3 Requests for approval of Contractor's means and methods.

.4 Requests for approval of corrective actions for deficient Work.

.5 Requests for coordination information already indicated in the Contract Documents.

.6 Requests for adjustments in the Contract Time or the Contract Sum.

.7 Requests for interpretation of Contract Administrator's actions on submittals.

.8 Incomplete RFIs or inaccurately prepared RFIs.

.2 Contract Administrator's action may include a request for additional information, in which case Contract Administrator's time for response will date from time of receipt of additional information.

.3 If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Contract Administrator in writing within 10 days of receipt of the RFI response. Failure to notify will result in the Work being included as part of the Contract.

.5 RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log with progress meeting minutes. Include the following:

.1 Project name.

.2 Name and address of Contractor.

.3 Name and address of Contract Administrator.

.4 RFI number including RFIs that were returned without action or withdrawn.

.5 RFI description.

.6 Date the RFI was submitted.

.7 Date Contract Administrator's response was received.

.6 On receipt of Contract Administrator action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Contract Administrator within 10 days if Contractor disagrees with response.

1.4 COORDINATION

.1 The Contractor is responsible for installing a complete, fully functional and fully operational system, and is responsible for reviewing all other trades' Drawings to ensure all electrical requirements are included in the Bid Opportunity price. Inform the Contract Administrator of any discrepancies during the Bid Opportunity process. Any discrepancies not identified, shall be incorporated by the Contractor at no cost during construction.

.2 The Contractor is responsible for coordination with all other trades and Contractors on Site.

.3 Through the General Contractor, coordination shall include regular meetings, exchange of Shop Drawings and other technical information. Compile working combined systems Drawings, where parts of the installation are complex or require input of several trades. Ensure the General Contractor is in attendance and is aware of all coordination. Obtain and exchange schedules with all other trades and Contractors to ensure Work which impacts another trade or Contract is completed in sufficient time.

.4 All Work is to be properly phased to enhance coordination.

1.5 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

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

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

1.6 SUBMITTALS

.1 Submit Shop Drawings, produce detailed data and samples in accordance with previous sections, as specified herein, and to Contract Administrator's satisfaction.

.2 Shop Drawings submitted electronically (e.g. by email) shall comply with the following:

.1 Shop Drawings larger than 11 x 17 shall include a hard copy delivered separately by messenger the same day as the email copies.

.2 All necessary transmittals shall be included with the email submission.

.3 Emailed Shop Drawings shall comply in all respects with this section of the Specifications.

.3 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or Material.

.4 Where applicable, include actual wiring, single line and schematic diagrams. Include all technical data and full details of each component.

.5 Include wiring diagrams showing interconnection with Work of other sections.

.6 Shop Drawings must reflect actual equipment being provided. Generic Shop Drawings are not acceptable and will be returned for re-submittal without Contract Administrator’s review.

.7 Shop Drawings of all equipment must be submitted to the Contract Administrator for review in sufficient time to enable him to retain them for at least ten (10) working days.

.8 Each applicable device to be highlighted or identified with an arrow.

.9 Each applicable device to be tagged (e.g. light fixture type, motor tag, etc.).

.10 Bind each system separately eg. Distribution, Fire Alarm, etc. One common binder from one supplier will not be acceptable.

.11 Shop Drawing submission shall include a photocopy of all applicable Specification sections showing a complete compliance/ non-compliance listing. Refer to spec. detail sheet "Shop Drawing Compliance List Sample" for example.

.12 Division 26 shall check all Shop Drawings and make necessary changes, or cause the supplier to make necessary changes, prior to submission to the Contract Administrator. Division 26 shall stamp Shop Drawings as evidence of review. Unreviewed Shop Drawings will be returned, marked revise and re-submit. Division 26 shall ensure the General Contractor and other affected Subcontractors review the Shop Drawings. Division 26 shall review other trades’ relevant Shop Drawings and stamp accordingly. Shop Drawings will be reviewed by the Contract Administrator and if re-submission is required, Division 26 shall ensure that the supplier's Drawings have been changed to comply before returning them to the Contract Administrator for review again.

.13 Review of the Shop Drawings by the Contract Administrator shall not relieve the Contractor from responsibility for errors and omissions therein.

.14 Each Drawing submission to bear the following signed stamp, and shall include name of project, equipment supplier, and clause number equipment is specified under.

CONTRACTORS CERTIFICATION
This Drawing has been reviewed by
(firm name)

All dimensions have been checked and found compatible with the Contract Drawings and all capacities, quantities, sizes, and other data contained in the Contract documents have been listed by the supplier on this Drawing and have been checked by the undersigned and found correct.

Date Per:

.15 Clearly show division of responsibility. No item, equipment or description of Work shall be indicated to be supplied or Work to be done "By Others" or "By Purchaser". Any item, equipment or description of Work shown on Shop Drawings shall form part of Contract, unless specifically noted to the contrary.

.16 Provide field dimensions required by electrical suppliers and Subcontractors. In cases where fabrication is required prior to field dimensions being available, check all related Drawings and obtain clarification from Contract Administrator if necessary.

.17 Main distribution and utility metering Shop Drawings must be approved by local utility prior to submission to Contract Administrator.

.18 Incomplete submissions will be returned for updating and re-submittal without Contract Administrator's review.

.19 Product Data: submit WHMIS MSDS in accordance with Division 01.

.20 Quality Control: in accordance with Division 01.

.1 Provide CSA or equivalent certified equipment and Material.
.2 Where CSA or equivalent 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.
.4 Permits and fees: in accordance with General Conditions of Contract.
.5 Submit, upon completion of Work, load balance report.
.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work.
.7 Other requirements as listed in Specification.

.21 Manufacturer's Field Reports: submit manufacturer's written reports, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in other sections.

1.7 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Division 01.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction and as per the conditions of Provincial or Territorial Act respecting manpower vocational training and qualification.

1.8 DELIVERY, STORAGE AND HANDLING

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

.2 Construction/Demolition Waste Management and Disposal: separate waste Materials for reuse and recycling in accordance with Division 01.

1.9 SYSTEM STARTUP

.1 Upon completion of the project, demonstrate the operation, care and maintenance of all system equipment and components in the presence of The City, or his representative, and the Contract Administrator. Obtain signed certification from the The City that such equipment was shown to be fully operational and that all necessary operating instructions have been provided.

1.10 DRAWINGS

.1 Drawings are intended to communicate the general design intent. They are not to be interpreted as a description of means and methods of construction. The Contractor is responsible for reviewing the Drawings and Specifications of this and all other trades on the project to ensure that they deliver a fully coordinated, complete and fully operational system. Any component or service not described, but reasonably obvious as required for completion shall be included by the Contractor at no cost.

.2 Carefully examine all Drawings and Specifications relating to all Work (including, but not limited to, all other disciplines' Drawings and specs), and all electrical Work indicated thereon shall be considered as a part of the Work by this section unless indicated otherwise. Prior to the date of the last addendum report at once to the Contract Administrator, any defect, discrepancy, omission or interference affecting the Work of this section, or the guarantee of same.

.3 Install all equipment as shown or as specified and in accordance with manufacturer's approved Shop Drawings.

.4 The Drawings accompanying these Specifications are intended to show the general arrangement and extent of the Work to be carried out, but the exact location and arrangement of all parts shall be determined as the Work progresses. The location of equipment, outlets, etc., as given on the Drawings are approximately correct, but it shall be understood that they are subject to such modifications as may be found necessary or desirable at the time of installation to meet any structural or architectural requirements. Such changes shall be implemented as directed by the Contract Administrator, without additional charge.

.5 Electrical Drawings do not show all structural and other details. Architectural and structural conditions shall govern, and this Section shall make without charge, changes or additions to accommodate these conditions.

.6 Where Drawings indicate the general location and route to be followed by conduit, cable, etc., these locations must be governed by job conditions. Where the required conduit, cable, and boxes are not shown on Drawings or only shown diagrammatically, they shall be installed to conserve maximum head room and interfere as little as possible with free use of space through which they pass. Maximum clearance above floor shall be maintained under all suspended conduit and equipment, unless otherwise shown on the Drawings, or approved by the Contract Administrator.

.7 Submit a complete set of Drawings for the proposed installation to the Inspection Department having jurisdiction and receive written approval before installation or fabrication of any equipment. No extra compensation will be allowed for any changes or rearrangement of any electrical apparatus or Materials necessary due to failure to receive this approval.

.8 Provide the Electric Utility with three copies of a Drawing showing the main distribution and the proposed method of metering for approval prior to the manufacture of equipment.

1.11 COORDINATION OF EQUIPMENT AND SERVICES IN CEILING SPACES, SERVICE ROOMS AND RISER SHAFTS

.1 Coordinate installation of equipment and services in ceiling spaces, service rooms, riser rooms and riser shafts with other trades.

.2 Install equipment and services in such way to utilize spaces efficiently and to maximize accessibility for installations and maintenance of equipment and services of all trades. Review requirements of other trades. Consider required clearances for maintenance and repairs of equipment provided by other trades.

.3 Examine Shop Drawings of equipment of other trades.

.4 Where equipment or services are installed in existing service rooms and riser shafts, visit these spaces to obtain details.

.5 Assign space priorities and lay out equipment and route services so they can be installed efficiently in these spaces and provide code-compliant access to equipment and services for maintenance.

.6 The location of equipment in ceiling spaces shall be such that it can be accessed for maintenance from a location immediately below the equipment, by two hands at a time.

.7 Where access to equipment or service is required for maintenance, removal or relocation of another equipment or service shall not be required.

1.12 PENETRATIONS IN STRUCTURAL MEMBERS

.1 Penetrations in structural members to be avoided if possible.

.2 Penetrations in existing structural members.

.1 Coordinate Work with structural for penetrations through existing structural members.

.3 Penetrations in new structural members.

.1 Coordinate Work with structural for penetrations through new structural members.

.2 Review structural Drawings.

.3 Coordinate steel Shop Drawings to include for penetrations of electrical services through structural members. Review structural steel Shop Drawings prior to submission to Contract Administrator for review.

.4 Installations that deviate from structural Drawings are not acceptable.

.5 Submit proposals for deviations to Contract Administrator for review.

1.13 AS-BUILT DRAWINGS INDICATING CONDUIT/CABLE RUNS & EQUIPMENT LOCATIONS

.1 Produce as-built Drawings in AutoCAD format describing the entire electrical as-built condition. Drawing shall indicate, but shall not be limited to:

.1 Record the horizontal and vertical routing of all electrical cables and conduits installed under this Contract. This includes the entire electrical distribution, all other Division's electrical systems, and lighting.

.2 Record Drawing information shall be organized and presented as follows. Each of the following groups of systems shall be recorded on separate record Drawing sets. Do not 'crowd' Drawings with as-built record information. Use additional Drawing prints as required.

.1 Normal Power: Power and receptacles for all cable/wiring 120 Volts or greater excluding lighting.

.2 Normal Power: Distribution Equipment Feeders.

.3 Record the location of the following: All power distribution equipment, cable splices, pull boxes, junction boxes, access fittings, power supplies and system control equipment, terminal cabinets, etc.

.2 Contract Administrator will provide the required number of 'white' prints of the Bid Opportunity Drawings, as requested by Div. 26.

.3 As Work progresses, record on one (1) set of Contract Drawings, installed conduit layout as well as any approved changes and deviations from the original Contract and/or working Drawings, including outlets, equipment and panel locations. Have these Drawings available for reference and observation at all times. At completion of Work, submit to the Contract Administrator, at the Contractor's Costs, AutoCAD Record Drawings and one hardcopy set of Record Drawings. The Contract shall not be considered complete and no final payment shall be made until these Drawings are accepted by the Contract Administrator. Provide separate Drawings for each system in order not to "crowd" Drawings.

1.14 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified.

.2 Provide one copy of Operation and Maintenance manuals to Contract Administrator for review. Operation and Maintenance manuals will be reviewed by the Contract

Administrator and if re-submission is required, ensure that the manuals have been changed to comply before returning them to the Contract Administrator for review again.

.3 Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of the electrical installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature alone is not acceptable.

.3 Wiring and schematic diagrams and performance curves.

.4 Names and addresses of local suppliers.

.5 Copy of reviewed Shop Drawings.

.4 Provide four (4) complete, hard-backed, D-ring loose leaf Maintenance Manuals. These shall consist of typewritten or printed instructions for operating and maintaining all systems and equipment provided under this section of the Specification. Manuals shall also contain Shop Drawings, wiring diagrams, test results, check lists, programming details and manufacturer's brochures on all equipment, together with typed index tab sheets. Manuals shall also contain a DVD with PDF files of the contents of the manuals.

1.15 EXAMINATION OF DOCUMENTS AND SITE

.1 Carefully examine all plans and Specifications pertaining to this Contract and become familiar with all details. Visit the Site and determine all factors affecting this section of the Work; include all costs for same in Bid Opportunity.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Division 01.

2.2 MATERIALS AND EQUIPMENT

.1 Provide Materials and equipment in accordance with Division 01.

.2 Equipment and Material to be CSA certified or certified by an equivalent recognized certifying agency to meet Canadian Standards. Electrical equipment consisting of individual certified components must also have a CSA or equivalent certification for the entire assembly. Where there is no alternative to supplying equipment which is certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.

.3 Submit for Contract Administrator's approval, a duplicate list of makes and types of all equipment and Materials for this project, prior to placing of orders for same. This shall be done within fourteen (14) days of the award of the project Contract to the General Contractor in order to avoid delays in delivery and completion.

.4 Any Material or equipment ordered or installed without the Contract Administrator's prior approval shall, if so directed by the Contract Administrator, be removed and replaced with approved Material or equipment without a change in the Contract price.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

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

.2 Supplier and installer responsibility is indicated in Motor Schedule on electrical Drawings, or in this Specification and related mechanical responsibility is indicated in Mechanical Equipment Schedule on mechanical Drawings and Specifications.

.3 Refer to other Sections of this Specification and to Drawings for responsibilities for control wiring and conduit.

.4 Coordinate with other trades. Identify any discrepancies during Bid Opportunity.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction and Contract Administrator.

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

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for type of conductors used.

2.6 EQUIPMENT IDENTIFICATION LABELS, SIGNS AND MARKINGS

.1 Equipment identification labels, nameplates, signs and markings: in accordance with requirements of authority having jurisdiction and Contract Administrator.

.2 To match existing where applicable.

.3 Confirm with authority having jurisdiction and Contract Administrator prior to manufacture.

.4 References:

- .1 ANSI Z535.1 – Safety Colors
- .2 ANSI Z535.2 – Environmental Facility and Safety Signs
- .3 ANSI Z535.3 – Criteria for Safety Symbols
- .4 ANSI Z535.4 – Product Safety Signs and Labels

.5 Equipment Identification

- .1 Identify electrical equipment with nameplates and labels as follows, and as indicated in other Specification sections:

.1 Nameplates: lamicoid 3mm thick plastic engraving sheet, black face with white core (black with white letters) 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 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.

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

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

.5 Nameplates for terminal cabinets, pullboxes and junction boxes to indicate system and/or voltage characteristics.

.6 CDP type distributions: indicate name, amperage, voltage, phases, wiring configuration and equipment fed from.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Transformers: indicate name, capacity, primary and secondary voltages.

.9 Room names and numbers used shall be actual room names and numbers that will be used on the project. Co-ordinate and confirm with trades involved.

.10 Co-ordinate names of equipment and systems with Mechanical section to ensure that identical names are used.

.11 Nameplates for control devices: indicate equipment controlled.

.12 Adjacent to each breaker in CDP type panelboards, provide and mount lamacoid nameplates identifying the respective load and location.

.6 Identification of equipment fed from multiple power sources

.1 Provide adhesive-backed vinyl on equipment, 3.5 mil thick, minimum size 76mm x 127mm , yellow background with black letters, with wording: "CAUTION – THIS EQUIPMENT IS SUPPLIED BY MORE THAN ONE POWER SOURCE. ENSURE ALL SOURCES ARE ISOLATED BEFORE WORKING ON EQUIPMENT."

.7 Receptacle Identification

.1 All convenience receptacles shall have a lamacoid size 1 plate on which the panel and circuit number from which it is fed, is indicated. The identification shall be mechanically secured to the coverplate on the appropriate outlet. Pressure indented adhesive strip nameplates are not acceptable and shall not be used.

.8 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders (coloured plastic tapes) and branch circuit wiring (numbered wire markers). Conductor marker identification shall correspond with panel or terminal board directory information.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system. Colour coding used shall be documented by individual systems in Maintenance Manuals.

.5 Insulated grounding conductors shall have a green finish and shall be used only as a grounding conductor.

.9 Conduit and Cable

.1 Confirm identification method with The City and Contract Administrator prior to start of Work.

.2 Identify conduit and cables as follows:

.1 At entry to and exit from equipment, within 300mm from equipment, including pull boxes and junction boxes.

.2 At penetrations through walls, ceilings, floors, at each side, within 300mm from penetration.

.3 At every 10m along the run.

.4 Label indoor and outdoor installation.

.5 Provide self adhesive vinyl labels, UV resistant, with following wording, as applicable:

.1 For normal power: “NORMAL POWER, 120/208V”, or with an appropriate voltage.

.2 CONTROLS

.3 Other systems, label as required.

.6 Label sizes per following table.

Outside Conduit/Cable Diameter		Minimum Length Label		Minimum Letter Height	
Inches	mm	Inches	mm	Inches	mm
.75-1.25	19-32	4	100	0.5	13
1.5-2	38-51	4	100	0.75	19
2.5-6	64-152	6	150	1.25	32

.7 Provide larger label to suit wording as required.

.8 Label colors

.1 Black letters on orange background. Wording shall be uppercase.

.9 Labels installed outdoors shall be rated for outdoor applications.

.10 Labels shall be manufactured in accordance to ANSI Z535.4 Product Safety Signs & Labels.

.11 Approved manufacturers or approved equal in accordance with B7

.1 GTS Sign Design

.2 Accent Striping & Lettering Co

.3 Branch circuit junction box identification

.1 Show circuit numbers in black felt marker on inside of covers.

2.7 FINISHES

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

.1 Color selection

.1 Indoor equipment, ASA61 (light grey).

.2 Outdoor equipment, “Equipment Green”

2.8 WORKMANSHIP AND MATERIALS

.1 The installation shall consist of Material and equipment specified unless as provided herein. Electrical equipment provided under this Contract shall be built in accordance with EEMAC standards and shall be C.S.A. certified (or certified by an equivalent recognized certifying agency to meet Canadian Standards) and/or locally approved. All equipment supplied under this Contract shall be new and the best of its respective kind and of uniform pattern throughout.

.2 Any Material or equipment ordered or installed without the Contract Administrator's prior approval shall, if so directed by the Contract Administrator, be removed and replaced with approved Material or equipment without a change to the Contract.

.3 Replace inferior Work if so ordered by Contract Administrator without a change to the Contract.

.4 Retain same foreman or superintendent on the job until completed, unless otherwise directed by the Contract Administrator.

.5 All tradesmen shall carry all tools on their person at all times. Any tool not in use shall be under lock and key in an area authorized by the building supervisor.

2.9 REQUEST FOR EQUAL

.1 Refer to clause B7 for substitute requirements.

2.10 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.11 SPARE PARTS

.1 The Contractor shall submit 15 days after Bid Opportunity closing a list of spare parts that the Contractor considers essential/important/useful to the operation of the systems described herein. This list shall be in addition to any spares/consumables called for in the Contract Documents and those which are required up to practical completion and hand over.

.2 Each spare part listed shall include the manufacturer's/ supplier's price including all mark-ups, delivery and packaging. The prices shall remain valid for 12 months following handover of the project.

.3 These spare parts may or may not be ordered during the Contract period. The Contractor shall only include these items in the Contract sum if specifically instructed to do so.

.4 Any spare parts listed shall be completely interchangeable with those specified in the Contract Documents and included in the works.

.5 Any spares ordered shall be delivered to the specified client's representative complete with all documents/instructions.

2.12 HOUSEKEEPING PADS

.1 All floor mounted electrical equipment shall be mounted on concrete housekeeping pads.

.2 Pad mounted equipment with doors that open to the bottom of the enclosure shall have horizontal struts installed between the enclosure bottom and the concrete pad to prevent the door from dragging on the concrete.

.3 All housekeeping pads for electrical equipment to be installed by sub-trade hired and paid by Electrical Contractor, unless noted otherwise.

.4 Where housekeeping pads for electrical equipment are required to be installed by General Contractor, notify General Contractor and provide required pad sizes.

.5 Housekeeping pad shall be 4” (100mm) high, rebar 10M @ 12” (300mm) o/c, each way top, unless noted otherwise.

.6 Housekeeping pad shall extend 4” (100mm) on each side of equipment.

.7 Chamfer top edge and corners.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 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 - GENERAL

.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

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

.3 Arrange for holes through exterior wall and roof to be flashed and made weatherproof.

.4 Redundant, unused or empty conduits, raceways, cable trays, supports, junction and pull boxes and other equipment, including associated cables and wiring, that was installed under this project but was not used shall be removed from the Site unless otherwise noted. Where conduits, raceways, cable trays, supports, junction and pull boxes and other equipment, including associated cables and wiring, were required to be installed to facilitate construction Work, such as temporary feeds these shall be removed from the Site unless otherwise noted.

3.4 MOUNTING HEIGHTS

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

.2 Review all other discipline's Drawings, including but not limited to architectural elevation details, millwork and headwall Drawings.

.3 If mounting height of equipment is not specified or indicated, verify with Contract Administrator before proceeding with installation.

.4 Install electrical equipment on wall at following heights unless indicated otherwise.

.1 Control Consoles: 1200mm.

.2 Panelboards: 2000mm to top.

.3 Disconnect Switches: 1200mm.

.4 Heights as above or at bottom of nearest block or brick course except where required to comply with Manitoba Building Code, other applicable codes, authorities having jurisdiction, etc.

.5 Heights and orientation to match existing where applicable except where required to comply with Manitoba Building Code, other applicable codes, authorities having jurisdiction, etc.

.6 Where multiple existing devices are present and are installed at different heights or orientations, confirm mounting height and orientation of new devices with Contract Administrator prior to rough in.

.7 All controls for the operation of building services or safety devices including electrical switches, thermostats, etc. that are intended to be operated by the occupant, must be mounted between 400mm and 1200mm above the finished floor (to comply with the Manitoba Building Code for accessibility to a person in a wheelchair).

.8 Notify Contract Administrator for any discrepancies related to mounting heights and orientations.

3.5 NEW BREAKERS IN EXISTING EQUIPMENT

.1 New breaker kA rating to match existing equipment bus kA rating.

.2 Where existing equipment bus kA rating is not available, obtain kA ratings of all existing breakers within equipment and match the breaker with highest kA rating.

.3 Provide breaker mounting hardware.

.4 If modifications to existing equipment are required for the installation of new breaker, re-certify equipment to maintain CSA certification or obtain approval from local Electrical Inspection Department or Authority Having Jurisdiction. Cover all costs for inspections and re-certifications.

.5 Program breaker trip unit per protective device coordination study.

3.6 FIELD QUALITY CONTROL

.1 General

.1 This Section specifies general requirements common to all starting and testing of electrical equipment and systems. Read this Section in conjunction with related Sections which specify specific portions of electrical starting and testing Work.

.2 Except where otherwise specified, arrange and pay for the testing and related requirements specified in this and related Sections.

.3 If test results do not conform with applicable requirements, repair, replace, or adjust or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

.1 Prior to testing ensure all electrical equipment is cleaned and free of dust.

.2 After testing, protect equipment subject to dust from construction activities.

.3 Do not conceal or cover equipment until observed and approved by Contract Administrator.

.4 Assume all liabilities associated with starting, testing and balancing procedures.

.5 Assume all costs associated with starting, testing, adjusting and balancing, including supply of testing equipment and witnessing.

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

.5 Coordinate starting of electrical equipment and systems with other Divisions.

.6 Notify Contract Administrator when starting and testing of all systems has been completed.

.7 Upon completion of the Work and adjustments of all equipment, all systems shall be operated in the presence of the Contract Administrator and The City to demonstrate that all equipment furnished and installed or connected as part of this section of the Contract shall function in the required manner as determined by the Contract Administrator. The City or Contract Administrator may elect to not attend demonstration.

.2 Reference Documents

.1 Perform tests in accordance with:

.1 These Contract Documents

.2 Requirements of authorities having jurisdiction

.3 Manufacturer's published instructions

.4 NETA Standard For Acceptance Testing Specifications for Electrical Power Equipment and Systems

.5 Other applicable standards

.2 If requirements of any of the foregoing are in conflict, notify Contract Administrator before proceeding with tests and obtain clarification.

.3 Witnessing of starting and testing on Site

.1 Where any equipment or systems requires testing prior to starting, ensure that such Work has been completed prior to starting of electrical equipment and systems.

.2 Prior to starting and testing of electrical equipment or systems, prepare a start-up and testing schedule of all tests specified.

.3 Review schedules with Contract Administrator and The City. Provide a complete schedule to the Contract Administrator and The City a minimum 2 weeks prior to commencement of testing.

.4 Advise Contract Administrator and The City of dates and times for all testing with sufficient advance notice (minimum three days) to allow Contract Administrator to make arrangements to attend.

.5 Contract Administrator or the The City may witness all or any portion of testing and starting procedures performed by Contractor or Contractor's Testing Agent.

.6 Contractor shall be present for all tests specified, even where test is being performed by a supplier or Subcontractor.

.4 Contractor's Testing Agent(s)

.1 Arrange and pay for services of testing agent(s) to perform tests and verifications, except for megger testing of wiring and equipment operating at 600V and below, which are acceptable to be meggered by the Contractor.

.2 Contractor's Testing Agent(s) Qualifications:

.1 Testing agent shall be independent of any Supplier, Contractor or Subcontractor and shall not have any financial or other interests in or with the Contractor.

.2 Approved testing agencies:

.1 IER

.2 Shermco Industries

.3 Contractor's Testing Agent(s) Report:

.1 Arrange for Contractor's Testing Agent(s) to submit PDF files of all test results, together with deficiency lists, and summary of tests, and include recommendations for any corrective action required directly to the Contract Administrator.

.5 Contractor’s and Manufacturer’s Reports

.1 Submit for Contract Administrator’s review completed test report forms in PDF file format immediately after each test is completed.

.2 After a test has been successfully completed, each test report shall contain a summary which clearly states that all results were satisfactory.

.3 Record all data gathered on Site on test report forms.

.4 Obtain test report forms from equipment manufacturers. When test report forms are not available of specific tests are requested in this Specification create your own test report forms based on those requirements. Where applicable, create test report forms based on samples provided in this Specification.

.5 Provide testing personnel names and signatures and date and time of testing.

.6 Note any damage, missing parts or incomplete Work on test form.

.7 Record date of corrected deficiencies on form.

.8 Maintain one copy on Site of all data taken during starting and testing period.

.9 Maintain one copy of all final starting, testing, balancing and adjusting reports on Site up to interim acceptance of the Work for reference purposes.

.10 Arrange for manufacturer to submit copies of all production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment to the Contract Administrator prior to shipping.

.11 Arrange for manufacturer to submit certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.12 Insert final test results, check lists, programming details and certifications in Maintenance Manuals.

.13 Provide calibration certificates for each test equipment.

.6 Test Equipment

.1 Provide all required test equipment.

.2 Test equipment must be calibrated within one year of testing.

.7 Contract Administrator's/The City's Performance Testing Agent(s)

.1 The Contract Administrator or The City, at his option, may arrange for services of a performance testing agent to separately test or re-test electrical equipment or systems.

.2 Performance testing agent may witness any or all tests or start-ups which are the responsibility of the Contractor.

.3 Performance testing of any system by the Contract Administrator or The City does not reduce the Contractors obligations for complete testing and start-up of systems as specified.

.8 Starting Motors

.1 Prior To Starting Motors:

.1 Confirm motor nameplate data with motor starter heater overloads, setting of MCP's and sizing of fuses.

.2 Verify rotation.

.3 Ensure disconnects are installed.

.4 Confirm labeling of motors, disconnects and starters.

.2 Measure and record operating load amp readings for all three phase motors.

.9 Correction Of Deficiencies

.1 Correct all Contract deficiencies found during electrical starting and testing of equipment and systems and Contract Administrator's performance verification.

.10 Basic Testing

.1 Perform the following testing:

.2 Bolted Conductor Terminations Testing

.1 Bolted conductor terminations shall be tightened to manufacturer's published torque values using torque tools.

.2 Torque tools shall be calibrated not more than one year before the date of use.

.3 Obtain torque values from equipment manufacturer.

.4 In absence of manufacturer's published torque values, use recommended tightening torque values from Canadian Electrical Code.

.5 For equipment rated 400A and above record torque values and provide report to Contract Administrator for review.

.3 Load Balance and Adjusting

.1 Where connecting new loads to existing switchgear, switchboards or panelboards: Perform load tests with as many loads on as possible and make necessary reconnection of single phase loads from one leg or phase to another to balance the load on legs or phases as nearly as possible.

.2 Revise equipment directories and wiring identification accordingly.

.3 Record all changes on Record Drawings.

.4 Submit, at completion of Work, report listing phase and neutral currents on affected CDP's, panelboards, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

.4 Voltage Testing and Adjusting

.1 Test and record voltage at new or existing equipment being installed or connected to: switchgear, switchboards, CDP's, panelboards, loads, secondary lugs of transformers, operating under normal load.

.2 Adjust transformer taps to within 2% of rated voltage of equipment/load.

.3 Record all changes on Record Drawings.

.4 Submit, at completion of work, report listing phase and neutral voltages at each location tested. State hour and date on which each load was measured, and voltage at time of test.

.5 Verification of protective device settings

.1 A certified testing agency normally engaged in field service equipment testing shall be engaged and shall test all circuit breaker settings as follows (to include new and existing breakers that require adjustment of settings):

.1 Verification of settings shall consist of:

.1 Testing of all circuit breaker solid state relays with the breaker manufacturer's test kit to verify at least 3 points on each time-current characteristic. One point shall be tested at the breakpoint of the characteristic at the high end and another point shall be tested at the breakpoint of the characteristic at the low end. The other points shall be tested along the straight line of the characteristic.

.2 The report shall be bound in a 3-ring loose leaf binder, similar to the Short Circuit and Time-Coordination Study, with title sheet, table of contents, purpose, test criteria, test equipment used, summary and test data. The test data shall list all devices in table form with both the actual tested values and the required values listed. All test values shall fall within +/- 10% of the required values. Necessary corrective action shall be taken to correct any problems and then re-tested until the equipment passes all required tests. Compare test results to the time current coordination study and confirm that the curves as actually tested provide the required coordination. After all tests and analysis has been completed successfully, the summary in the final report shall clearly state that all equipment has successfully passed all tests and is in good operating condition. The test report shall be certified by the testing agency and shall be signed and sealed by a Professional Engineer responsible for the testing.

.6 Insulation resistance testing:

.1 Branch circuits and feeders rated 1000V and less:

.1 Rated up to 350V with a 500V instrument.

.2 Rated 350V - 600V with a 1000V instrument.

.7 Test all circuits and wires for continuity and high impedance grounds.

.8 Those circuits which test non-continuous, with an insulation resistance less than minimum recommended resistance or with high impedance grounds shall be replaced.

.9 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.

3.7 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of Drawings and Specifications for examination and approval prior to commencement of Work.

.2 Pay all associated fees for inspection of the Work by authorities having jurisdiction.

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

.4 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of Work to Contract Administrator. Copies to be included in Maintenance Manuals.

3.8 RESPONSIBILITY

.1 Be responsible for any damage caused to The City, or their Contractors due to improperly carrying out this Work.

.2 Install all components of this Work promptly and where applicable, in advance of concrete pouring, or similar construction. Provide and set in the proper sequence of construction, all sleeves, hangers, inserts, etc. and arrange for all necessary openings, where required to accommodate the electrical installation.

.3 Work shall be arranged in co-operation with other Divisions of this Specification in such a manner that it doesn't interfere with the progress of the project. In areas where ducts or pipes must be installed along with conduit or cable, co-operate with other divisions so that the finished job will represent the most efficient use of the space.

.4 In no case proceed with any Work in uncertainty. Obtain, from the Contract Administrator, any clarification necessary and thoroughly understand all portions of the Work to be performed.

3.9 CLEANLINESS AND CLEANING

.1 Maintain a clean tidy job Site. All boxes, crates, and construction debris due to this portion of the Work shall be neatly piled outside the construction area and shall be removed at least weekly during the construction period. All construction areas shall be kept clear of debris.

.2 Before the project will be accepted by The City, all new electrical equipment shall be clean and free of dust, plaster, paint, etc. Any existing equipment which is scratched or damaged shall be refinished or replaced if so designated by the Contract Administrator.

3.10 MODIFICATIONS

.1 Locations of all convenience receptacles, outlets, switches, etc. are subject to modification by the Contract Administrator, who reserves the right to move these up to 3000 mm from the position shown, without change to the contract price, provided notice is given before the related Work has commenced.

3.11 ENGINEERING OBSERVATIONS

.1 The term "Contract Administrator" in all electrical sections of Specification shall mean:

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R3H ON3

.2 Guidance will be offered to Contractor in interpretation of plans and Specifications to assist Contractor to carry out Work. Observation and directives given to Contractor does not relieve Contractor and his agents, servants and employees of their responsibility to erect and install Work in all its parts in a safe and workmanlike manner, and in accordance with all relevant Codes, Standards, plans and Specifications, nor does it impose upon The City, and/or Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any Work.

.3 Contractor shall notify Contract Administrator of completion of Work at various stages. Notification shall be made as a minimum as noted below (provide minimum 5 working day’s notice), whereupon the Contract Administrator may visit Site to periodically observe the Work:

.1 After distribution equipment is installed into final location, but before energization. All distribution equipment shall be left with covers removed to allow for an internal review of distribution.

.2 After main feeders and grounding and bonding conductors are installed and terminated.

.3 At first energization of equipment,

.4 At commissioning,

.5 At final completion of project,

.6 At demonstration of operation of equipment.

.4 The Contract Administrator is not responsible for inspection of the Contractor’s Work. The Contract Administrator maintains the right to observe the Work at its sole discretion. In addition to the above, Contractor's Work may be observed periodically by The City, and/or Contract Administrator or their representatives, without notice or without request from Contractor, solely for purpose of determining general quality of Work, and not for any other purpose. None of the above relieves the Contractor of their responsibility to adhere to the requirements of relevant Codes and Standards and the Contract Documents.

.5 Where observation reports are submitted, the Contractor is responsible for rectifying issues noted in the Observation Reports in a timely manner and before covering up the Work or affecting access to it.

3.12 GUARANTEE

.1 Guarantee the satisfactory operation of all Work and equipment supplied and installed as a part of this section of the Specifications.

.2 Replace forthwith, at no additional Material or labour cost, any part which may fail, or prove defective within a period of twelve (12) calendar months after the final acceptance of the complete installation, provided that such failure is not due to improper usage, or ordinary wear and tear.

.3 No certificate given, payment made, partial or entire use of the equipment by the The City or his representative shall be construed as acceptance of defective workmanship or Materials.

.4 This general guarantee shall not act as a waiver of any specified guarantee or special equipment guarantees covering a greater length of time.

3.13 CUTTING AND PATCHING

.1 Cutting, patching and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment and piping, and/or installation of new equipment and piping in existing building(s) to be included by Electrical Subcontractor in Bid Opportunity price. Employ and pay appropriate Subcontractor whose Work is involved, for carrying out Work described above.

.2 Mark all openings required for conduits, cables, ducts, and the like.

.3 Description:

.1 Perform all cutting and patching required for installing electrical systems.

.2 Retain services of General Subcontractors to carry out actual Work involved in cutting wall openings, floor openings and the like, and in patching up after installation has been completed.

.3 Cutting to be 'neat' sizes. Patch all edges such as cover plates, etc. Hide cut edges.

.4 Perform all cutting only of existing surfaces as required as a result of the removal and/or relocation of existing equipment and conduit and/or installation of new equipment and conduit in the existing building. Include for such Work in bid price.

.5 If, in the opinion of Contract Administrator, cutting of holes has been improperly performed (i.e. too large for conduits or cables) Do all patching per original Specifications and cover all costs.

3.14 FIRESTOPPING

.1 Where cables or conduits pass through floors, block or concrete walls and fire rated walls, seal openings with 3 M Brand Fire Barrier Products or approved substitute in accordance with clause B7, to maintain fire rating.

.2 Seal all holes resulting from removal of cables, conduits and equipment.

.3 Fireproofing of electrical cables, conduits, trays, etc. passing through fire barriers shall conform to local codes and inspection authorities.

.4 Refer to following table for 3M brand Fire proofing products and to B7 for equivalents.

Pentrating Item	3M Brand Fire Barrier Product Options	Range of Applications			Concrete Walls and Assemblies		Gypsum Wall Assemblies	
		Penetrating Items	Annular Space	Maximum Opening Size	F Ratings (Hrs)	T Ratings (Hrs)	F Ratings (Hrs)	T Ratings (Hrs)
1. Plastic Pipe/ Conduit & Cast-in Coupling	FS-195+ Wrap Strip, CP 25WB+ Caulk or MP Moldable Putty+	PVC: 8 in. Nominal Diameter 4 Wraps/Application	0.2 in.	9 in. Diameter	2	2	2	1-1/2
		PVC: 4 in. Nominal Diameter 3 Wraps/Application	0.75 in.	6 in. Diameter	3	2	2	2
		ABS: 4 in. Nominal Diameter 3 Wraps/Application	0.75 in.	6 in. Diameter	2	2	1-1/2	1-1/2
	PSS 7904 Penetration Sealing System with CP 25 WB+ Caulk	PVC: 4 in. Nominal Diameter	3.0 in.	10 in. Diameter	3	1/2	- -	- -
		ABS: 4 in. Nominal Diameter	3.0 in.	10 in. Diameter	3 (in wall) 1 (in floor)	3 (in wall) 0 (in floor)	- -	- -
		PB: 2 in. Nominal Diameter	3.0 in.	8 in. Diameter	1/2	- -	- -	- -
2. Metal Pipe and Conduit	CP 25WB+ Caulk	1 in. Depth of Caulk: 20 in. Diameter	2.5 in.	22.5 in. Diameter	3	0	2	0
	FS-195+ Wrap Strip, CP 25WB+ Caulk or MP Moldable Putty+	4 in. Nominal Metal Pipe	1.75 in.	8 in. Diameter	2	0	2	2
	CS-195+ Composite Sheet with FS-195+ Wrap Strip and CP	4 in. Nominal Metal Pipe (Multiple Pipes)	45.0 in.*	30 x 50 in.	4 (both sides) 3 (one side)	3/4 0	- -	- -

	25WB+ Caulk or MP Moldable Putty+							
	PSS 7902 Penetration Sealing System CP 25 WB+ Caulk or MP Moldable Putty+	10 in. Nominal Diameter Pipe and 8x16 in Rectangular Cover Plate if fill is less than 10%	9.0 in.	10 x 20 in.	3	0	- -	- -
	CP 25WB+ Caulk	1/2 in. Diameter Depth of CP-25WB 12 in. Nominal Diameter Pipe	1.2 in.	14 in. Diameter	3	0	- -	- -
	FD 150 FireDam Caulk	2 in. Depth of FireDam 150 Chaulk 6 in. Nominal Diameter Pipe	2.0 in.	8-1/4 in. Diameter	3	0	- -	- -
	MP Moldable Putty+	1 in. Depth of Putty: 10 in. Nominal Diameter Pipe	0.75 in.*	12-1/4 in. Diameter	2 (1/2 in. Depth) 3 (1 in. Depth)	0	- -	- -
3. Insulated Electrical and Communications Cable	CP 25WB+ Caulk	1 in. Depth of Caulk; 43% of Area Filled, 350 MCM Cable and 100 Pair Telephone Cable	0.75 in.	6 in. Diameter	3	0	2	1-1/2
		1 in. Depth of Caulk; 37% of Area Filled, 3/0 350MCM Cable and 100 Pair Telephone Cable	0.75 in.					
		2-12 in. Depth of Caulk; 59% of Area Filled, 7C/12 AWG Cable, 100 Pair Telephone Cable	0.75 in.					
	FS-195+ Wrap Strip with CP 25WB+ Caulk or MP Moldable Putty+	4 in. Depth of Caulk with FS-195 Wrap; 59% Area Filled, 350 MCM Cable	0.75 in.	6 in. Diameter	2	0	- -	- -

	CS-195+ Composite Sheet with FS-195+ Wrap Strip and CP 25WB+ Caulk or MP Moldable Putty+	Multiconductor 12 AWG Cable, 100 Pair PVC Telephone Cable, Cable Bundle 3 in. Diameter	47.0 in.*	30 x 50 in.	4	1	- -	- -
	PSS 7904 Penetration Sealing System with CP 25 WB+ Caulk	350 MCM Cable; 30% of Area Filled. Cover Plate required if Fill is less than 10%	11.0 in.	8 x 16 in.	3	1/2	- -	- -
	MP Moldable Putty+	Telephone Cable; 100 Pair, 40% or Area Filled	0.75 in.	6-1/4 in. Diameter	2	0	- -	- -
4. Cable Tray	CS-195+ Composite Sheet with CP 25WB+ Caulk	Nominal Size Cable Tray 4 x 24 in.; 39% Area Filled in Tray; Cable Size: 300 MCM 4 in. Depth of Chaulk	14.64 in.	12 x 24 in.	3	0	- -	- -
	PSS 7904-R Penetration Sealing System with CP 25 WB+ Caulk	Nominal Size Cable Tray 4 x 18 in.; 52% Area Filled in Tray; 25 Pair No. 22 AWG Telephone Cable	9.0 in.	10 x 20 in.	3	3/4	- -	- -
5. Blank Openings and Construction Joints and Expansion Trenches	CP 25WB+ Caulk	1/2 to 1 in. Depth	- -	Joint Width	3	3	- -	- -
		2 in. Depth Cover Plate required when joint width exceeds 2 in.	- -	4 in. Diameter Opening 4 in. Joint Width	3	2	- -	- -
	MP Moldable Putty+	1 in. Depth	- -	1 in. Joint Width	2	2	- -	- -
	PSS 7904 Penetration Sealing System with CP 25 WB+ Caulk	4 in. Depth of Kit. Cover Plate Required.	- -	8 x 16 in.	3	1	- -	- -

* Distance Measured from the outer edge of the pentrant to the furthest edge of the opening

3.15 EQUIPMENT SECURITY

.1 Provide temporary locking system, comprising of padlocks, equipment door locks, keys, etc. during construction period, to prevent unauthorized access to components within equipment.

.2 Equipment doors shall be kept locked (with keys removed from padlocks and locks) at all times, except when Work is performed on actual equipment.

.3 At completion of Work, remove temporary locking system from equipment.

.4 Equipment door locks and keys provided by equipment manufacturers to remain. Hand over to The City such keys, tagged with equipment names.

.5 No equipment shall remain without means for locking at any time.

3.16 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with an appropriate voltage in English.

3.17 SCHEDULING OF WORK

.1 Existing buildings will remain in use during construction. Arrange Work so that interruption of services is kept to a minimum. Obtain permission from The City prior to cutting into electrical services. Where deemed necessary by Contract Administrator, temporary electrical shall be installed and/or Work shall be carried out at night and on weekends.

.2 Contractor to maintain continuous and adequate all existing electrical systems and other services during entire time of this Contract. Provide temporary conduit, wire, equipment, etc. where necessary to meet this requirement.

3.18 DEMOLITION OF EXISTING ELECTRICAL

.1 Remove all unnecessary existing electrical equipment, wiring, fixtures, in those portions of the existing building which are being remodelled or demolished. All devices/fixtures, etc. are not necessarily shown on the plans. The City shall select from the Materials and/or equipment remaining that which he wishes to retain, and the remainder shall be removed from the Site. Any electrical equipment in remodelled sections or in structures removed or altered, adjacent to new Work, necessary for the operation of existing building, shall be relocated as necessary. All existing equipment re-used shall be made good and guaranteed. Power interruptions to be kept to a minimum and shall be at a time suitable to the building occupant. Refer to Architectural plans for demolition areas/phasing.

.2 Drawings do not show all electrical requiring removal to accommodate renovations such as receptacles, switches, lights, starters, motors, components, heaters, etc. Visit Site and refer to Drawings and include all costs for demolition.

.3 Refer to Specification Section 26 05 05 - Work in Existing Building.

3.19 MAINTENANCE PLAN

.1 Provide maintenance plan, in accordance to CSA Z463 – Maintenance of Electrical Systems, for major pieces of electrical equipment, for new and existing, including but not limited to the following: transformers, distribution panels, disconnects, circuit breakers, feeders.

.2 Provide two (2) hard copies of maintenance plan in hard-backed, D-ring loose leaf binders and one DVD with PDF files of the maintenance plan.

.3 Maintenance plan shall include:

.1 General maintenance instructions
.2 Details on frequency of maintenance
.3 Specific details on maintenance procedures at each maintenance interval
.4 Duration of each maintenance procedure.
.5 Required equipment shutdown.
.6 Look-ahead schedule in a task based, time scaled GANNT chart (one bar per activity).
.7 Identify requirements for shutdown on GANNT chart.
.8 Test forms and test equipment calibration requirements.

.4

3.20 INTERIM AND FINAL OCCUPANCY CERTIFICATION BY CONTRACT ADMINISTRATOR

.1 Interim Occupancy Certification

.1 When final occupancy is not practical due to project phasing or The City's requirements an interim occupancy may be granted for a finished portion of the Site.
.2 A Certification letter for Interim Occupancy, will be issued to the Authority Having Jurisdiction (AHJ), by the Contract Administrator, under seal of a Professional Contract Administrator solely for the purpose of applying for Interim Building Occupancy Permit, under following conditions:
.1 The construction was carried out in substantial compliance with the applicable provisions of the Electrical By-laws, the Manitoba Building Code and the Manitoba Energy Code for Buildings and the plans and Specifications submitted in support of the application for the building permit. This shall include any additional plans, documents and design decisions that have been part of the Contract that were not detailed as part of the submitted permit application.
.2 Distribution breakers shall be set to the approved coordination study.
.3 No open wiring shall be present, all terminations shall be installed in a box with cover.
.4 All electrical installations shall be made safe.
.5 All applicable life safety systems shall be fully commissioned, tested and certified by respective testing agencies.

.6 Certification sheets and test reports shall be submitted to Contract Administrator with no deficiencies.

.7 Electrical and Building permit numbers, project name and address shall be submitted to Contract Administrator.

.8 All Observation Reports shall be submitted to the Contract Administrator, clearly indicating that all deficiencies relating to any of the above are complete. Any items not completed shall be clearly indicated, and the Contractor shall provide a date indicating when the Work will be complete.

.2 The interim occupancy certification letter will not be issued until all information required above, including final certification sheets and test reports are received by Contract Administrator, with no deficiencies.

.3 The interim occupancy certification letter will state the applicable non-life-safety exceptions and points of non-compliance with the Electrical By-laws, the Manitoba Building Code and the Manitoba Energy Code for Buildings.

.4 The letter will also state how long the building may be occupied under these conditions, without compromising the health or safety of occupants.

.5 The decision as to whether the Letter of Certification for Interim Occupancy is to be issued lies entirely with the Contract Administrator of Record, and it is incumbent on the Contractor to successfully demonstrate to the satisfaction of the Contract Administrator of Record that the building is ready for Interim Occupancy. Ultimately, once the Letter of Certification for Interim Occupancy is provided to the AHJ, the decision as to whether an Interim Building Occupancy Permit is to be granted lies with the AHJ.

.6 Final Occupancy Certification

.1 A Certification letter for Final Occupancy, shall be issued to the Authority Having Jurisdiction (AHJ), by the Contract Administrator, under seal of a Professional Contract Administrator solely for the purpose of applying for Final Building Occupancy Permit, under following conditions:

.1 The building is to be complete. As such, all items noted in the Interim Occupancy Certification Letter and any correspondence with the AHJ shall be complete including but not limited to the following (all systems may not apply):

.1 All receptacles and switches are installed

.2 All device covers are installed

.3 All panel covers are installed

.4 Electrical equipment is identified with name plates

.5 Panel directories are completed and installed.

.6 Where required, a certified fire alarm verification report shall be submitted 3 working days before the date the Letter of Certification is required.

.7 All non-life-safety exceptions and points of non-compliance noted under Interim Occupancy Certification, including all deficiencies noted on Contract Administrator’s Observation Reports are completed in compliance with all applicable codes and standards and the plans and Specifications submitted a minimum of 3

working days ahead of the date required for the Letter of Certification, in support of the application for the building permit. This shall include any additional plans, documents and design decisions that have been part of the Contract that were not detailed as part of the submitted permit application.

.8 All electrical installations are made safe.

.7 Certification letter will not be issued until all information required above, including final certification sheets and test reports are received by Contract Administrator, with no deficiencies.

.8 The decision as to whether the Letter of Certification for Final Occupancy is to be issued lies entirely with the Contract Administrator of Record, and it is incumbent on the Contractor to successfully demonstrate to the satisfaction of the Contract Administrator of Record that the building is ready for Final Occupancy. Ultimately, once the Letter of Certification for Final Occupancy is provided to the AHJ, the decision as to whether a Final Building Occupancy Permit is to be granted lies with the AHJ.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 26 05 21 - Wires and Cables.

.3 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

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

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

.2 Canadian Standards Association (CSA)

.1 CSA C22.2No.0.4, Bonding and Grounding of Electrical Equipment.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal.

1.4 COORDINATION

.1 The building shall remain open and in normal operation during the construction period.

.2 Where existing services such as electrical power, fire alarm system, gas detection system, etc. are required to be disrupted and/or shut down, coordinate the shut-downs with The City and carry out the work at a time and in a manner acceptable to them. Carefully schedule all disruption and/or shut-downs and ensure that the duration of same is kept to the absolute minimum. Submit for approval a written, concise schedule of each disruption at least 120 hours in advance of performing work and obtain The City's written consent prior to implementing.

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

.4 If existing equipment shown on drawings is defective it shall be brought to the Contract Administrator and The City's attention prior to work completion.

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

1.5 EXISTING DEVICES IN NEW CONSTRUCTION

.1 Existing junction boxes in walls and ceiling spaces required to maintain existing circuits shall remain accessible.

.2 Where services are concealed within walls, floors or ceilings and cannot be visually identified, Contractor shall provide electronic scanning devices or other approved means to locate and identify concealed services prior to drilling.

1.6 SCHEDULE OF WORK

.1 Carefully note and refer to the Contract Administrator's general schedule of work and include for all requirements to conform to it.

Part 2 Products

2.1 MATERIALS

.1 Provide all materials required for the complete interface and reconnection installation as herein described and as indicated on the drawings.

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

Part 3 Execution

3.1 INSTALLATION

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

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

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

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 Clamps or connectors for armoured cable, aluminum sheathed cable, flexible conduit as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install pressure type wire connectors and tighten according to manufacturers recommendations.

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

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

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2 and NEMA.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 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 CSA C22.2 No. 38 Thermoset Insulated Wires and Cables.

.3 CSA C22.2 No. 51 Armoured Cables.

.4 CSA C22.2 No. 131, Type TECK 90 Cable.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 26 05 00 - Common Work Results - For Electrical.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for power cables for incorporation into Operation and Maintenance Manual.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and

.1 Operation and maintenance instructions for cable, connectors, splices, terminations kits, etc. to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Certified copy of factory test results.

.3 Certified copy of site test results.

.4 Maintenance and overhaul instructions.

.5 Spare parts list.

Part 2 Products

2.1 BUILDING WIRES

.1 Wires and cables manufactured to CSA 22.2 No. 38.

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

.3 Copper conductors: size as indicated, with minimum 600 V insulation of cross-linked polyethylene (XLPE) material, rated RW90. For burial installations use RWU90.

2.2 AC90 (BX, COPPER)

.1 Cable to C22.22 No.51

.2 Conductors: Solid copper #12 AWG, stranded copper #10 AWG and larger, minimum size #12 AWG.

.3 Insulation: 600V, cross-linked polyethylene (XLPE), 90°C.

.4 Configuration: Multi-conductor, complete with a separate bare copper conductor.

.5 Armor: Bare interlocked aluminum.

2.3 TECK CABLE

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

.2 Conductors:

.1 Bonding conductor: copper.
.2 Phase conductors: copper, size as indicated. Minimum size 12 AWG.

.3 Insulation:

.1 Cross-linked thermosetting polyethylene rated type RW90, minimum 1000 V.
.2 Colour code: Black, red, blue and white in 4C cable.

.4 Inner jacket: Polyvinyl chloride (PVC) material.

.5 Armour: interlocking aluminum.

.6 Outer jacket: PVC jacket, FT4 rated.

.7 Fastenings:

.1 One hole straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
.2 Channel type supports for two or more cables.
.3 Threaded rods: Minimum 6 mm dia. to support suspended channels.

.8 Connectors:

.1 To be approved for TECK cable.

2.4 LOW VOLTAGE CONTROL CABLES (BELOW 30VAC)

.1 Type LVT.

.2 Manufactured in accordance with CSA C22.2 N°35.

.3 Sizes, 18 and 16 AWG solid copper, insulated, color coded conductors.

.4 Insulation voltage rating: 30VAC

.5 Insulation temperature rating: -20 to +60 Celsius.

.6 Green colored conductor for bonding.

.7 Aluminum/mylar shield with tinned copper drain wire.

.8 Outer jacket over conductors and shield, sunlight resistant PVC.

.9 Rip cord under jacket for jacket stripping.

Part 3 Execution

3.1 GENERAL

.1 To Minimize Voltage Drop

.1 All branch circuits including lighting circuits shall be minimum #10 AWG for all circuits longer than 21 metres and shall be minimum #8 for all circuits longer than 35 metres.

.2 All branch circuit wiring and conduit shall be installed to minimize voltage drop. Install additional conduit runs as required to take the most direct and shortest route to outlets, equipment, etc.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems.

.2 In cabletroughs (only where noted on drawings).

3.3 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Group cables wherever possible on channels.

.2 Single conductor cables shall be installed one cable diam. apart on suspended cable tray or channel supports and shall be clamped with aluminum cable clamps. Cables shall be terminated using non-magnetic connectors. Cable armor shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG bare (unless otherwise noted) copper ground wire shall be installed with each feeder. Cable bending radius shall be at least twelve times the overall cable diam. and bends shall not damage or distort the outer sheath.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Type AC90 armoured cable (BX) shall be used for connections from conduit systems to recessed luminaires in accessible ceilings. Cable to be of sufficient length to allow the lighting fixture to be relocated to any location within a 6' (1.8M) radius. Cable shall be clamped before entering the lighting fixture and shall be clipped before entering the conduit system junction box.

.2 Type AC90 armoured cable (BX) shall be used for connections from conduit systems to wiring devices in steel stud partitions and for interconnection of wiring devices within steel stud partitions, cable to be clipped before entering junction or outlet boxes. Cable to be clamped within partitioning with steel galvanized tie-wire.

3.5 INSTALLATION OF LOW VOLTAGE CONTROL CABLES (BELOW 30VAC)

.1 Type LVT without interlocked aluminum armour shall be installed in conduit.

.2 Armoured LVT in steel stud walls.

.3 All connections shall be in a junction box.

.4 Confirm cable configuration with equipment manufacturer wiring requirements.

.5 Bond cable shield to ground.

.6 Indoor installations only.

3.6 INSTALLATION IN EQUIPMENT

.1 Group and lace-in neatly wire and cable installed in switchboards, panelboards, cabinets, wireways and other such enclosures.

3.7 TERMINATIONS

.1 Terminate wires and cables with appropriate connectors in an approved manner.

.2 Compression adapters intended to terminate larger feeders on small lugs are not acceptable. All lugs, including breaker lugs, are to be sized to accommodate the cable being terminated.

3.8 IDENTIFICATION

.1 Wire in conduit #2 AWG and smaller shall have solid coloured insulation, colour coded as listed below.

.2 Wire in conduit 1/0 AWG and larger and single conductor cables for normal power feeders shall be identified at each outlet box and termination with a 150 mm band of coloured vinyl tape of the appropriate colour. Emergency power feeders shall be provided with an additional 75 mm band of red vinyl tape installed adjacent to the 150 mm band of the coloured phase identification tape, as listed below. Neutral and ground conductors shall be identified. Paint or other means of colouring the insulation shall not be used.

.3 Colour code wire in conduit and single conductor cables as follows:

Phase A - red
Phase B - black
Phase C - blue
Neutral - white
Ground - green

.4 Maintain phase sequence and colour coding throughout project.

.5 Use colour coded wires in communication cables, matched throughout system.

.6 Identify control conductors in motor control equipment, contactors, fire alarm panels, etc. with mylar/cloth wire markers.

.7 Refer to 26 05 00 for additional requirements.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

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

1.2 REFERENCES

.1 CSA C22.2 No. 0.4, Bonding of Electrical Equipment

.2 CSA C22.2 No. 41, Grounding and Bonding Equipment

.3 IEEE 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00 - Common Work Results - For Electrical.

Part 2 Products

2.1 EQUIPMENT

.1 Grounding and bonding conductors shall be green insulated, unless noted otherwise, stranded copper, sized in accordance with the Canadian Electrical Code, minimum #12 AWG.

.2 When insulated conductors are installed in free air inside buildings, conductors shall be type RW-90, FT-4 rated.

.3 Use one or two hole copper compression lugs for grounding and bonding connections in equipment.

.4 Compression connectors, lugs, etc., used in outdoor locations, shall have bolts, nuts, etc., of silicon bronze alloy.

.5 Grounding for control power shall be separated from power grounding and shall only be bonded to power grounding at only one point.

.6 Non-corroding accessories necessary for grounding and bonding systems, type, size, material as indicated, including but not limited to:

.1 Grounding and bonding bushings.
.2 Bolted type conductor connectors.
.3 Pressure type conductor connectors.
.4 Bonding jumpers, braided straps.

Part 3 Execution

3.1 INSTALLATION

.1 General (Applies to bonding and grounding)

.1 Install complete, permanent, continuous, system and power circuit, equipment, grounding and bonding systems including but not limited to conductors, connectors, bushings, accessories, as indicated, to conform to Canadian Electrical Code, applicable standards and requirements of local authority having jurisdiction.

.2 Conductors shall be continuous, without splices.

.3 Protect exposed conductors from mechanical damage by rigid metal conduit, steel guards, or other suitable shields. Bond metal guards to ground.

.4 Where grounding or bonding conductors are installed in metal conduit or other metallic encasement, the conductors shall be permanently and effectively bonded to the conduit/encasement at both ends of its length. Use solderless lugs, grounding clamp or ground bushing at each end. This requirement applies to all such conduits/encasements regardless of length.

.5 Where conductors pass through fire rated floor, or wall, etc., provide rigid metal conduit of the required size. Connect each conduit end to the conductor with solderless lug, grounding clamp or grounding bushing.

.6 All surfaces to which conductors are to be bolted shall be cleaned of all paint and applied with rust preventing agent.

.7 Connections between dissimilar metals such as between copper and steel, must be thoroughly sealed or painted against moisture to minimize corrosion.

.8 Install conductor connectors in accordance with manufacturer's instructions.

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

.10 Provide labels at each end on grounded, transformer neutral grounding and bonding and grounding conductors inside equipment.

.2 Bonding to ground

.1 The bonding of the electrical equipment and systems shall conform to the requirements of the electrical code, referenced standards, the inspection authority having jurisdiction and as described in this specification and as shown on the drawings.

.2 Install bonding conductor for flexible conduit, connected at both ends to conduit by using grounding bushing, solderless lug or grounding clamp.

.3 In wet or damp areas and near tanks containing liquids, all equipment frames, tanks, boxes, outlets, etc., shall be bonded to ground.

.4 Bond single conductor, metallic armoured cables to ground at supply end, and provide non-metallic entry plate at load end.

.5 Conduit runs containing feeders and branch circuits shall be complete with an insulated green bonding conductor, bonded to all outlet boxes, junction boxes, pull boxes, equipment enclosures, equipment ground busses, etc. The conduit system shall be continuous but shall not be relied on to serve as the equipment bonding means.

.6 Bonding conductors shall be sized according to the Canadian Electrical Code, but shall be minimum #12 AWG.

.3 Grounding

.1 The grounding of the electrical equipment and systems shall conform to the requirements of the electrical code, referenced standards, the inspection authority having jurisdiction and as described in this specification and as shown on the drawings.

3.2 TRANSFORMER BONDING AND NEUTRAL GROUNDING

.1 Delta/Wye Solidly Grounded Transformers:

.1 The primary bonding conductor shall be run in the same conduit as the primary feeder to the transformer (when primary feeder is in conduit).

.2 The secondary neutral conductor, where present, and the secondary bonding conductor, shall be run in the same conduit as the secondary feeder from transformer (when secondary feeder is in conduit).

.3 The secondary neutral conductor, where present, shall be connected to XO point of the transformer.

.4 Bond primary and secondary bonding conductors and transformer XO point in accordance to Canadian Electrical Code and requirements of Authority Having Jurisdiction.

.5 For transformers with primary or secondary voltage ratings above 750V provide two grounding conductors from transformer ground bus to ground grid. Install to opposite sides of ground grid. Install conductors in such a way that should one grounding conductor become disconnected or damaged, no equipment enclosure may become isolated from ground.

.6 For liquid filled transformers, bond transformer tank/transformer enclosure to primary and secondary bonding conductor with continuous conductor from tank/enclosure ground lug through connector on ground bus to primary and secondary bonding conductor.

3.3 SINGLE CONDUCTOR CABLE METAL SHEATH GROUNDING

.1 Single conductor cables shall have their metal armor, tape shields or concentric neutral conductors bonded to ground at the supply end only. The metal armor, tape shields or concentric neutral conductors shall be isolated from ground at the load end. Provide non-metalic entry plate at load end for cables with metal armor.

.2 Bond metal armor, tape shields or concentric neutral conductors to ground by #2/0 green insulated copper conductor at starting end of cable.

.3 For cables that shall have their metal armor, tape shields or concentric neutral conductors bonded to ground at both ends, refer to drawings.

.4 A separate bonding conductor shall be installed with the single conductor cables to carry the fault current, and shall be bonded to ground at each end.

3.4 BONDING EQUIPMENT ENCLOSURES TO GROUND

.1 Connect bonding conductors installed with feeders to non-current carrying parts of equipment included in, but not necessarily limited to following list: panelboards, transformers, frames of motors, starters, control panels, etc.

.2 Make bonding connections in radial configurations only.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size and thickness as required, surface mounted, suspended, or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to masonry surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

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

1.2 SUBMITTALS

.1 Submit Shop Drawings and product data for cabinets in accordance with Section 26 05 00 - Common Work Results - For Electrical.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.3 Cast type with gasketted covers.

Part 3 Execution

3.1 JUNCTION, PULL BOXES, CABINETS AND ENCLOSURE INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.4 Install junction and pull boxes clear of all mechanical ductwork and piping.

.5 Support boxes, greater than 4-11/16 x 4-11/16 inches, with independent threaded rod from structure, independent from the conduit support system.

3.2 IDENTIFICATION

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

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

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

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.4 Flexible metal conduit: to CSA C22.2 No. 56, and liquid tight flexible metal conduit.

.5 Minimum size of conduit shall be 19mm.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole 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.

.4 Threaded rods to support suspended channels, sized for the load.

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 Steel set screw connectors and couplings. Insulated throat liners on connectors.

.4 Raintight connectors and fittings c/w O-rings for use on weatherproof or sprinklerproof enclosures.

.5 Raintight couplings to be used for conduit installations exposed to moisture or sprinkler heads.

.6 Explosion proof in hazardous areas to meet requirements of authorities having jurisdiction.

2.4 FISH CORD

.1 Polypropylene with 3M spare length at each conduit end.

Part 3 Execution

3.1 INSTALLATION

.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

.2 Produce layout sketches of conduit runs through mechanical and electrical service areas in order to pre-avoid any conflict with other construction elements and to determine the most efficient route to run conduit.

.3 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.4 Use electrical metallic tubing (EMT) except where specified otherwise.

.5 Use explosion proof flexible connection for connection to explosion proof motors.

.6 Install conduit sealing fittings in hazardous areas. Fill with compound.

.7 Minimum conduit size: 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 Dry conduits out before installing wire.

.13 Conduit stubs from floor slabs where exposed to damage to be rigid galv. steel.

.14 The conduit sizes as shown or indicated are the minimum acceptable and shall not be reduced without the approval of the Contract Administrator.

.15 Conduit to be sized as per Canadian Electrical Code or as shown on drawings and specifications. Note that the sizes of branch circuit conductors scheduled and/or specified on the drawings are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with Canadian Electrical Code. Where conductor sizes are increased to suit voltage drop requirements, increase the conduit size to suit.

.16 Running threads will not be permitted; proper couplings shall be used.

.17 All conduit runs passing across expansion joints of the building shall be installed utilizing approved expansion fittings, and bonding devices.

.18 Refer to 26 05 00 for identification requirements.

.19 All conduit systems in hazardous areas to be rigid galvanized steel to meet the requirements of the authorities having jurisdiction.

.20 No power driven pins (Ramset) shall be utilized to secure any portion of the conduit.

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.

.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.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Unless specifically noted, do not embed conduit into concrete. Except with the approval of the Structural Engineer, all conduit runs embedded in concrete shall not be larger in outside diameter than one quarter (1/4) the thickness of the slab, or beam in which they are embedded, nor shall they be spaced closer than three diameters on centre, nor so located as to impair unduly the strength of the construction. In no case shall the conduits

be placed so that there is less than 25mm of concrete covering. All conduit runs in concrete shall be inspected and approved by Contract Administrator or his representative before concrete is poured. Conduit shall not be embedded in floating concrete slab construction unless specifically indicated otherwise.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

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

.3 Section 26 05 26 - Grounding.

1.2 REFERENCES

.1 American National Standards Institute

.1 ANSI/IEEE C57.96, Guide for Loading Dry-Type Distribution and Power Transformers

.2 ANSI/IEEE C57.110, Recommended Practice for Establishing Liquid-Filled and Dry-Type Power and Distribution Transformer Capability When Supplying Nonsinusoidal Load Currents

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA C9, Dry-Type Transformers

.2 CAN/CSA C9.1, Guide for Loading Dry-Type Distribution and Power

.3 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type) Transformers

.4 CAN/CSA C802.2, Minimum Efficiency Values for Dry-Type Transformers.

.5 CAN/CSA C802.3, Maximum Losses for Power Transformers

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA 260, Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas

1.3 REGULATORY REQUIREMENTS

.1 CSA label required.

1.4 SOURCE QUALITY CONTROL

.1 Submit to Contract Administrator PDF file of standard factory test certificates for each transformer.

1.5 SHOP DRAWINGS

.1 Submit shop drawings and product data.

.2 Include:

.1 Dimensioned drawings showing the following:

.1 Front and rear view, left and right view, floor plan and roof plan of enclosure

.2 Core and coil
.3 Locations of externally mounting devices
.4 Locations of primary and secondary terminals
.5 Location of cable supports
.6 Location of taps
.7 Conduit entry/exit locations
.8 Location of low voltage compartments

.2 Technical data:
.1 kVA rating
.2 Primary and secondary voltages
.3 Primary and secondary continuous current
.4 Frequency
.5 Polarity or angular displacement
.6 Full load efficiency
.7 Heat loss at no load and at full load
.8 Tap regulation at unity power factor
.9 Basic Impulse Level (BIL)
.10 Impedance
.11 K-Factor
.12 Maximum inrush current at 0.1 second
.13 Insulation class
.14 Temperature rise
.15 Overload capacity without any loss of life
.16 Time duration of overload
.17 Sound rating
.18 Enclosure NEMA rating
.19 Core and coil, enclosure and total weight
.20 Internal and external component layout
.21 Winding schematic diagram and wiring diagrams
.22 Low voltage component(s) schematic and wiring diagrams

.3 Where applicable, submit the following additional information:
.1 Busway connection detail
.2 Connection details between close-coupled assemblies
.3 Composite floor plan of close-coupled assemblies
.4 Key interlock scheme drawing and sequence of operations

.4 Where more than one transformer is used on the project, provide transformer name on each page of shop drawing submission.

Shop drawings must reflect actual transformer(s) being provided. Generic shop drawings will be returned without reviewing. Incomplete submissions will be returned without reviewing.

1.6 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for transformers for incorporation into manuals.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver transformers individually wrapped.

.2 Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

.3 Do not stack transformers.

.4 Temporary heating: If transformer cannot be stored in a space that is continuously under normal control of temperature and humidity, apply temporary heat according to manufacturer's written instructions until evidence of condensation is no longer visible.

1.8 EXTRA MATERIALS

.1 Submit one can of paint for touch-up.

Part 2 Products

2.1 TRANSFORMERS

.1 Supply and install air cooled dry type distribution transformers.

.1 Full load temperature rise not exceeding 150 deg. C at ambient temperature of 40 deg. C with class 220 deg. C insulation.

.2 To be capable of carrying overloads without any detrimental effects as outlined in CSA C9.1.

.2 Shall be designed for continuous operation at rated kVA, 24 hours per day, 365 days per year, with life expectancy in accordance with ANSI/IEEE C57.96.

.3 Shall be 1.2 kV class having a BIL of 10 kV and shall have a dielectric test at 4 kV 60 cycle for one (1) minute on HV and LV windings.

.4 The transformers shall have an impedance in the range of 3% to 5% substantiated on the nameplate and by test results for transformers up to 225 kVA (minimum 3.75% for 225 kVA transformers and 5% for transformers 300 kVA and larger).

.5 Sound levels: In accordance with CSA C9.

.6 Transformer efficiency: In accordance with the latest edition of the Manitoba Energy Code for Buildings.

.7 The primary taps shall be 4 - 2-1/2%, two F.C.A.N. and two F.C.B.N.

.8 Voltage and KVA ratings and wiring configuration as shown on drawings.

.9 Core and Coil Assembly

.1 Transformer core shall be constructed with high-grade, non-aging, silicon steel with high magnetic permeability, low hysteresis and eddy currents. The core volume shall allow efficient transformer operation at 10% above nominal tap voltage. The core laminations shall be tightly clamped and compressed.

.2 Continuous windings with terminations brazed or welded. The winding shall be epoxy encapsulated providing rigid construction and quieter operation. The windings shall withstand short circuit stresses up to 25 times normal load current for two seconds. Furnish primary and secondary pads with minimum two holes for each cable connection.

.3 Core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot-spots and seal out moisture.

.4 The windings shall be brought out to accessible terminal boards for tap changing and for line and load connections.

.5 All primary, secondary and ground connections shall be two hole long barrel copper compression lugs sized to the conductor. Multi ranging lugs and dieless crimpers shall not be used. Provide appropriate buss termination pads to accept two hole long barrel copper compression lugs.

.6 Suitable vibration mounts shall be provided to eliminate sound transmission. These isolators shall be between core and coils and enclosure, and between enclosures and housekeeping pad. Vibration mounts to be B-line or equal, ND type for floor mount and HLS/HS type for hung transformers.

.10 K-Factor rating:

.1 Transformer to be K-1 rated (feeds pumps with full voltage starters).

.11 Enclosure

.1 Shall be ventilated, made of heavy gauge steel.

.2 Wiring compartment suitable for conduit entry and large enough to allow convenient wiring.

.3 Maximum temperature rise of the enclosure per applicable CSA standard.

.4 The core of the transformer shall be bonded to enclosure with flexible copper conductor.

.5 Enclosure shall have provisions for lifting.

.6 Enclosure shall be NEMA 3R.

.7 Enclosure finish shall be ANSI 61 color, weather resistant.

2.2 APPROVED MANUFACTURERS

.1 BMAG, Delta, Eaton, Hammond, Rex Manufacturing, Schneider, Siemens, or approved substitute in accordance with clause B7.

.2 All transformers shall be of same manufacturer.

2.3 EQUIPMENT IDENTIFICATION

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

.2 Label size: 7.

Part 3 Execution

3.1 MOUNTING

.1 Mount dry-type transformers up to 75 kVA as indicated.

.2 Mount dry type transformers above 75 kVA on (100mm) high concrete housekeeping pad.

.3 Ensure adequate clearance around transformer for ventilation. Provide minimum 300mm clearance at back and side of transformers.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Mount transformers with vibration isolation.

.8 Vacuum and clean transformer.

3.2 CONNECTIONS

.1 Make primary and secondary connections indicated on wiring diagram, in accordance with manufacturer's instructions.

.2 Provide grounding and bonding wiring and connections.

.3 Where conduit and wire is specified provide minimum 1 m liquid tight flexible conduit c/w steel liquid tight connectors and wire at the transformer.

.4 Energize transformers immediately after installation is completed, where practicable.

.5 Measure primary and secondary voltages and adjust transformer taps.

.6 Adjust transformer taps to provide secondary voltage, at maximum load, within +5% and -3% of nameplate voltage.

.7 Notify Contract Administrator if secondary voltage cannot be adjusted within recommended voltage range by adjusting transformer taps.

.8 Record load current, primary and secondary voltages and tap positions in a field report form.

.9 Include factory test reports and field reports in Maintenance Manuals.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

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

.2 Section 26 28 21 – Moulded Case Circuit Breakers.

1.2 REFERENCES

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

.2 ASTM - American Society of Testing Materials

.3 CSA C22.2No.0.4, Bonding and Grounding of Electrical Equipment (Protective Grounding).

.4 CSA Standard C22.2 No. 29 - Panelboards and Enclosed Panelboards

.5 CSA Standard C22.2 No. 5 - Molded Case Circuit Breakers

.6 NEMA AB 1 - Molded Case Circuit Breakers

.7 NEMA PB 1 - Panelboards

.8 NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.3 SUBMITTALS

.1 Submit shop drawings and product data.

.2 Indicate on shop drawings:
- .1 Power ratings.
- .2 Enclosure type.
- .3 Single line diagrams.
- .4 Breaker sizes, and kA ratings.
- .5 Trip unit models and sizes.
- .6 Trip unit range of each adjustable setting.
- .7 Bus kA rating (bracing).
- .8 System kA rating.
- .9 Customer meter model (if applicable).
- .10 Floor or wall anchoring method and foundation template.
- .11 Dimensioned cable entry and exit locations.
- .12 Dimensioned position and size of bus.
- .13 Overall length, height and depth of complete distribution.
- .14 Dimensioned layout of internal and front panel mounted components.
- .15 Weight of each section.

.3 Include time-current characteristic curves for breakers as required for the coordination study.

1.4 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into maintenance manuals.

1.5 STORAGE

.1 Store distribution on site in protected dry location. Cover with plastic to keep off dust.

1.6 APPROVED MANUFACTURERS

.1 Eaton, Schneider Electric and Siemens, or approved substitute in accordance with clause B7.

Part 2 Products

2.1 RATING

.1 Distribution shall be totally enclosed, dead front fabricated from formed and welded #12 gauge steel and front accessible only. Verify with plans for maximum overall dimensions. The distribution shall be CDP type.

.2 Distribution shall have door in door design. The distribution trim shall be hinged to the tub to allow full access to all buswork, wireways, breakers, etc. in the interior of the distribution. Bolted trim is not acceptable. A separate door in the trim shall allow access to the front of the breakers. Door over breakers to have lock. All locks to be keyed alike.

.3 Feeder circuit breakers shall be moulded case of sizes and types as shown on the drawings. Each circuit breaker shall have the continuous ampere rating engraved into breaker handle such that rating is clearly visible after installation of panel cover.

.4 All breakers to be CDP type breakers using CDP type connector mounting hardware. Smaller frame breakers that require additional mounting means, additional panelboard interiors, etc. will not be allowed.

.5 Breakers with 400A frames and smaller shall utilize twin breaker hardware mounting kits. Breakers shall be mounted double wide to save space.

.6 All current carrying components such as buswork, interconnecting components, etc. shall be tin plated copper. No aluminum components are allowed.

.7 Bus bars shall extend the full length of each section. Copper ground bus shall be continuous and extend through main breakers or switch section and each feeder breaker section.

.8 Distribution enclosure shall be treated to inhibit rusting and painted with a primer and two (2) coats of ASA61 grey enamel.

.9 Enclosure shall be NEMA 12 and protected from spray from sprinkler heads as outlined in Canadian Electrical Code.

.10 All breakers shall have individual lamacoid nameplates securely fastened with rivets on panel cover adjacent to respective breaker.

.11 Interrupting capacity of circuit breakers shall be RMS symmetrical at applied voltage and as follows:

.1 Up to 250V bus and breakers interrupting capacity (RMS Symmetrical) as shown on drawings, 10 ka minimum when not shown.

.2 347/600V panelboards: bus and breakers interrupting capacity (RMS Symetrical) as shown on drawings, 14 ka minimum when not shown.

.12 All devices must be fully rated. Series rated devices are not acceptable.

.13 Double tub distributions are to be sub-feed type.

.14 Distribution to have full height vertical bus.

.15 Distribution shall have a metal frame welded to the inside of panel door, as large as possible but minimum (220 x 280mm) (9" x 11"), and shall be c/w typewritten index card and protective transparent cover. On shop drawings, indicate proposed size of metal frame.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification per Section 26 05 00.

Part 3 Execution

3.1 INSTALLATION

.1 Locate distribution as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Distribution shall be wall mounted or floor mounted on concrete housekeeping pad.

.3 Connect breakers in distribution to feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Program all trip units per settings provided by Contract Administrator. Test all breakers after trip units are programmed.

.6 Provide test report to Contract Administrator for review.

.7 Incorporate test report in maintenance manuals.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 26 05 21 - Wires and Cables.

.3 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.5 Section 26 28 23 - Disconnect Switches - Fused and Non-Fused up to 1000V.

1.2 REFERENCES

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

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

.2 Canadian Standards Association (CSA)

.1 CSA C22.2No.0.4, Bonding and Grounding of Electrical Equipment (Protective Grounding).

1.3 SYSTEM DESCRIPTION

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

1.4 COORDINATION

.1 Review mechanical Shop Drawings prior to submittal to the Contract Administrator. Resolve internal conflicts prior to submission.

.2 Verify electrical supply characteristics of equipment prior to rough-in. Report any discrepancies immediately. Revise wire sizing, device type, connection type, breaker size, etc., as required, to accommodate the electrical supply characteristics of the equipment.

Part 2 Products

2.1 MATERIALS

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

.2 Include interlocks, conduit, wire, devices and fittings required to provide controls for mechanical equipment.

.3 Unless otherwise noted, motors, motor starter and and control panel shall be supplied by hoist system manufacturer.

2.2 EXTERIOR EQUIPMENT

.1 All equipment mounted on the exterior of the building shall be weatherproof.

Part 3 Execution

3.1 POWER WIRING

.1 Provide feeder wiring to equipment, but not limited to the following: starters, disconnects, etc, and make connections to associated mechanical equipment.

.2 Provide branch circuit wiring to equipment, but not limited to the following: control panels, control transformers.

3.2 COORDINATION

.1 Confirm exact location of control devices and other equipment requiring an electrical connection.

.2 Obtain wire sizes and quantities from equipment manufacturers.

.3 Coordinate wiring requirements with other Divisions and provide control wiring and connections as required to make the control systems operate as specified.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

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

.2 Section 26 23 00 - Low Voltage Switchgear.

.3 Section 26 24 13 - Switchboards (Above 1200 A).

.4 Section 26 24 16 - CDP Type Distribution (Up To 1200 A).

.5 Section 26 24 17 - Panelboards Breaker Type.

.6 Section 26 24 19 - Motor Control Centres.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, 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).

1.3 SUBMITTALS

.1 Submit product data & shop drawings in accordance with Section 26 05 00 - Common Work Results - For Electrical.

.2 Include time-current characteristic curves for breakers.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters: to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. 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 of breakers with adjustable trips to range from 5-10 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 All devices must be fully rated. Series rated devices are not acceptable.

.7 Interrupting ratings (RMS symmetrical) to match bus interrupting ratings shown on drawings.

.8 When interrupting ratings are not shown on drawings shall be as follows:

.1 Up to 250 Volts - 10,000 Amps

.2 347/600 Volts - 14,000 Amps

.9 Maximum breaker sizes, except for motors:

.1 20A for #12 copper conductor.

.2 30A for #10 copper conductor.

2.2 THERMAL MAGNETIC BREAKERS DESIGN

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

2.3 MAGNETIC BREAKERS DESIGN

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

2.4 SOLID STATE TRIP BREAKERS

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

.1 Each breaker shall have the following independent and fully adjustable curve shaping characteristics:

.1 Adjustable long time pickup
.2 Adjustable long time delay
.3 Adjustable short time pickup
.4 Adjustable short time delay with selective curve shaping
.5 Adjustable instantaneous pickup with instantaneous OFF function
.6 Adjustable ground fault pickup (where shown on drawings)
.7 Adjustable ground fault delay with selective curve shaping (where shown on drawings)

.2 Breakers feeding transformers 45 kVA and larger shall have solid state trips, fully and independently adjustable LSI settings.

.1 The range of the instantaneous settings shall be suitable for coordination with the inrush current of the protected transformer. The band of the instantaneous portion of the breaker time-current curve must clear the transformer inrush current at value which is 12 times the transformer full load current.

2.5 ARC FAULT CIRCUIT INTERRUPTERS (AFCI)

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

.2 Integrated processor which trips the breaker upon recognized unique current and/or voltage signatures associated with arcing faults.

2.6 APPROVED MANUFACTURERS

.1 Eaton, Schneider Electric and Siemens, or approved substitute in accordance with clause B7.

2.7 REQUIRED FEATURES

.1 Include:

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operating mechanism.

.1 It shall be possible to equip MCCB's with a motor mechanism for electrically controlled operation. An auto/manual switch in front shall, when set to the manual position, lock out electrical control; when set to auto, lock out the manual control; remote indication of manual or auto mode shall be possible. It shall also be possible to seal the access to the auto control. Closing shall take place in less than 80 ms.

.2 Following tripping due to electrical faults (overload, short circuit, earth fault), remote reset shall be inhibited. It shall however be possible if opening was initiated by a voltage release.

.3 The operating mechanism shall be of the stored energy type only.

.4 The addition of a motor mechanism or a rotary handle shall in no way affect circuit breaker characteristics:

.1 Only three stable tripping mechanism positions (on, off, and tripped) shall be possible with the motor mechanism,

.2 Suitability for isolation shall be provided by positive contact indication (on and off) in front of the motor mechanism module.

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

.7 Handle accessories.

.1 Circuit breaker handle accessories shall provide provisions for locking handle in the on and off position.

.8 Real time metering

.1 Trip units shall be available to provide real time metering. Metering functions shall include, but shall not be limited to, the following:

.1 Current (phases, neutral, average, maximum).

.2 Voltage (phase-to-phase, phase-to-neutral, average, unbalance).

.3 Power (active [kW], reactive [kVAR], apparent [kVA], power factor).

.4 Energy (active [kW h], reactive [kVAR], apparent [kVA]).

.5 Frequency.

.6 Total harmonic distortion (current, voltage).

.7 Metering accuracy shall be 1.5 percent current (above 600A), 1.0 percent current (600A and below), 0.5 percent voltage, and 2 percent energy. These accuracy's shall be total system, including, but not limited to, CT and meter.

.2 Measurement chain shall be independent from the protection chain.

.3 The measurements shall be displayed [on the breaker itself] [on a remote display][on a remote system via Modbus communication].

.4 Displays mounted on breakers or remote displays

.1 Shall operate continuously and independently of measured load size (shall display values at any load current).

.2 If powering of displays cannot be supported by breaker/trip unit itself, provide additional power supply module inside distribution c/w blue LED pilot light.

.3 Pilot light shall be mounted on the trim, indicating “Control power”.

.4 The power module shall be provided with form “C” alarm contact and shall be fed from a breaker or fuse block within the distribution.

.5 Connections from circuit breaker to remote display and/or communication module shall be plug-n-play via RJ45 connector. No special tools or programming shall be required.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Program/adjust programmable/adjustable breakers

.3 Test breakers as follows:

.1 Breakers in switchgear.

.2 Breakers in switchboards.

.3 Breakers in CDP’s.

.4 Breakers in MCC’s.

.5 Main breakers in panelboards.

.6 Breakers in panelboards that are sub-feeding panelboards.

.7 Individually mounted breakers.

.8 Programmable/adjustable breakers.

.9 Refer to specification Section 26 05 00 for details on testing.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

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

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 26 05 00 - Common Work Results - For Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4, Enclosed Switches.

.2 CSA C22.2 No.39, Fuseholder Assemblies.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switch in CSA Enclosure and size as indicated.

.2 Enclosure shall be NEMA 12.

.3 Metal enclosure with provision for padlocking in on-off switch position by three locks.

.4 Mechanically interlocked door to prevent opening when handle in ON position.

.5 Quick-make, quick-break action, heavy duty industrial grade.

.6 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

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

.2 Indicate name of load controlled and voltage on size 6 nameplate.

2.3 APPROVED MANUFACTURERS

.1 Eaton, Schneider Electric and Siemens, or approved substitute in accordance with clause B7.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches as indicated.

.2 Install additional brackets, supports, etc. required for mounting the disconnect switches.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Soil Investigation Data – Eng-Tech Report 19-217-03 dated Aug 14, 2019.

1.2 REFERENCES

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

.1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m ;).

.5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m;).

.6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-[December 2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System For New Construction and Major Renovations.

.4 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

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

1.3 SITE CONDITIONS

.1 For sub-surface investigation soil boring logs refer to Appendix. The complete soil report is available.

1.4 UTILITY LINES

.1 Before commencing work, establish location and extent of underground utility lines in areas of excavation. Notify Contract Administrator of findings.

.2 Remove abandoned utility lines in the area of work. Cap or otherwise seal lines at cut-off points.
.3 Record locations of maintained, re-routed and abandoned underground utility lines.
.4 Repair and pay for damage to existing utility lines resulting from work.

1.5 PROTECTION

.1 Protect bottoms of excavations from softening. Should softening occur, remove softened soil and replace with compacted Type 5 Fill.
.2 Construct banks in accordance with local by laws.
.3 Provide adequate protection around benchmarks and geodetic monuments.
.4 Provide protection to ensure no damage to existing facilities and equipment situated on site.
.5 Use approved measures to minimize dust as result of work.
.7 Do not stockpile excavated material at the work area or in the occupied garage areas.
.8 Excavated material to not interfere with site operation or drainage.
.8 Provide shoring as required to protect adjacent property and structures. All shoring design and drawings to be submitted under seal of an engineer registered in the province of Manitoba for review and approval.

1.6 COMPACTION DENSITIES

.1 Compaction densities are percentages of maximum densities obtainable from ASTM D698-70 and correct as noted.

1.7 UNSATISFACTORY SOIL CONDITIONS

.1 Any unsatisfactory or questionable soil conditions revealed during excavation shall be reported immediately to the Contract Administrator.
.2 All foundation and sub-structural work shall cease until the condition has been examined and approval to proceed has been issued.

1.8 MATERIAL UNSUITABLE FOR BACKFILL

.1 The Contractor shall be responsible for all costs associated with the excavation and removal of all materials unsuitable for backfill.

1.9 WATER

.1 Keep excavation free from water at all times. Provide drainage trenches and sumps as necessary and pump water well away from excavation. Do not discharge water onto garage floor or into occupied areas.

1.10 INSPECTION AND TESTING

.1 Testing of materials and compaction will be carried out by testing laboratory designated by Contract Administrator and as described in Division 0.

.2 Sieve analysis: Proposed fill materials will be tested to confirm suitability for intended use and conformity with specifications.

.3 Frequency of Tests

.1 Excavated surfaces: When undisturbed excavated surface is being prepared, make a series of 3 test of surface for each 500m2 area.

.2 Fills under floor or other slabs on grade: Make 3 tests for every 2 lifts of compacted fill.

PART 2 MATERIALS

2.1 GRANULAR MATERIALS:

.1 Type 1 Fill (Base Course): (Grade A) Clean, angular crusher run natural stone, free from shale clay, friable materials, roots and vegetable matter and graded within the following limits:

Screen Size:	% Passing:
25.4 mm	100
19 mm	85 – 100
13.2 mm	65 – 90
9.5 mm	50 – 73
4.75 mm	35 – 55
1.18 mm	15 – 40
300 um	5 – 11
75 um	2 – 8

.2 Type 2 Fill (Sub-base): (Granular – Type 1) Hard, durable, granular aggregate to be within the following limits when tested to ASTM C117-80 and ASTM C136-76 (AASHTO T27-78 and T11-78) and giving smooth curve without sharp breaks when plotted on semi-log grading chart:

Screen Size:	% Passing:
75 mm	95 - 100
25.4 mm	50 – 90
4.75 mm	20 – 60
425 um	5 - 35
75 um	0 – 5

.3 Type 3 Fill: Low plastic clay or low plastic clay till.

.4 Type 4 Fill: Clean, washed, coarse sand free from clay, shale and organic matter and less than 5% passing the 75 um sieve.

.5 Type 5 Fill: Pit-run gravel free from silt, clay, loam, friable or soluble materials, vegetative matter and graded as follows:

Screen Size:	% Passing:
75 mm	100
4.75 mm	40 – 80
0.075 mm	3 – 10

.6 Type 6 Fill: Durable and well graded, crushed stone, maximum sieve size 100 mm with 5 – 10% passing the 75 um sieve.

.7 Type 7 Fill (Filter Gravel): Free draining, river washed “pea” gravel, clean natural stone, free from shale, clay, friable materials, sand and fine particles, organic matter and other deleterious materials. Maximum size agreegate 12mm.

2.2 STOCKPILING

.1 If required stockpile fill materials in areas designated by the Contract Administrator. Stockpile granular materials in manner to prevent segregation. Protect stockpile fill materials from freezing or washing out.

.2 Protect fill materials from contamination.

PART 3 EXECUTION

3.1 EXCAVATING

.1 Excavate to elevations and dimensions indicated for installation, construction and inspection of work specified.

.2 Excavate to well defined lines to minimize quantity of fill material required.

.3 Earth bottoms of excavations to be dry undisturbed soil, level, free from loose or organic matter.

.4 Excavation must not interfere with normal 45-degree splay of bearing from bottom of any footing.

.5 Dispose of surplus and unsuitable excavated material off site.

.6 Do not obstruct flow of surface drainage.

.7 Notify Contract Administrator when soil at bottom of excavation appears unsuitable and proceed as directed by Contract Administrator.

.8 Obtain Contract Administrator review of completed excavation.

.9 Remove unsuitable material from trench bottom to extent and depth directed by Contract Administrator.

.10 Correct unauthorized excavation at no extra cost as follows:

- .1 Fill under bearing surfaces and footings with concrete specified.
- .2 Fill for trenching with Type 4 fill compacted to minimum of 95% maximum dry density to ASTM D698-78.
- .3 Fill under other areas with Type 2 fill compacted to 100% maximum dry density to ASTM 0698-78.

.11 Cut trenches 300 mm wider than maximum pipe, conduit, cable, diameter. Trim and shape trench bottoms and leave free of irregularities, lumps or projections.

.12 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.13 Provide shoring to Provincial Safety Standards.

3.3 BACKFILLING

.1 Do not commence backfilling until areas of work to be backfilled have been reviewed by the Contract Administrator.

.2 Areas to be backfilled shall be free from debris, snow, ice, water or frozen ground. Backfill and filling material shall not be frozen or contain ice, snow or debris.

.3 Do not backfill around or over cast-in-place concrete within 2 days of placing.

.4 Backfill simultaneously each side of walls and other structures to equalize soil pressure.

.5 Where temporary unbalanced earth pressures can develop on walls or other structures, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by the Contract Administrator.

.6 Place and compact fill materials in continuous horizontal layers not exceeding 300 mm loose depth. Use methods to prevent disturbing or damaging buried services, insulation, waterproofing. Repair any damage.

3.4 FILL TYPES AND COMPACTION

.1 Dimensions specified in following paragraphs are minimum dimensions of fill after compaction.

.2 Exterior side of perimeter beams: Use Type 2 fill to subgrade level. Compact to 95% density.

.3 Within building areas / Under Basement Slab:

.1 Once excavation has reached the design subgrade elevation, the subgrade should be inspected by the geotechnical engineer prior to placement of fill.

.2 Where inspection does not indicate the presence of localized soft conditions, the clay subgrade should be scarified, moisture conditioned and compacted to a minimum of 95% of SPMDD, using a heavy sheepsfoot (padfoot) roller, prior to placing sub-base. In order to limit the potential swell, the clay should be moisture conditioned on the wetter side of optimum.

.3 Sub-base material can be placed directly on the compacted sub-grade.

.4 The sub-base shall consist of 200mm of Type 2 Fill compacted to 98% of SPMDD.

.5 The base course shall consist of 150mm of Type 1 fill compacted to 100% of SPMDD.

.6 Provide polyethylene vapour barrier under slab as per section 033000.

.7 Protect sub-grade from frost, desiccation and inundation prior to, during, and after construction.

.8 Any fill materials required between the approved subgrade and the underside of the slab section noted above should consist of additional granular sub-base, uniformly compacted to 98% of SPMDD.

.4 Under slabs on grade: Provide minimum 150 mm Type 1 Fill compacted to 95% density. Allow for sand layer under precast concrete pavers.

.5 Underground Services:

.1 Pipe and conduit bedding and immediate protective cover: cradle half diameter of pipe or conduit using Type 4 fill. After pipe or conduit is in place, cover with 300 mm depth of Type 2 Fill.

.2 Cable and cable duct bedding and immediate protective cover: cover bottom of trench with 150 mm of Type 4 Fill. After cables and ducts are in place, side fill ducts with hand tampers and cover with 150 mm of same material.

.3 Fill above protective cover: in areas within buildings and where paving and walks occur, fill remainder of trench with Type 2 Fill. In other areas, fill to subgrade level using Type 2 Fill.

.4 Compaction (unless noted otherwise): compact bedding and immediate protective cover to 95% density, in areas within buildings and where paving and walks occur, compact remainder of fill to 95% density. In other non-loaded areas compact remainder of fill to 90% density.

.5 Notify Contract Administrator prior to backfilling of trenches for electrical services.

.6 If, during progress of work, tests indicate that fills do not meet specified requirements, remove defective fills, replace and retest at no extra cost.

.6 Backfill for foundation walls and structures:

.1 Install weeping tile as per section 33 46 21 – Foundation and Underslab Drainage. Cover Pipe with Type 7 Fill (Filter Gravel). Hand place surrounding material in uniform layers not exceeding 150mm compacted thickness. Do not drop material directly on pipe. Compact each layer from pip invert to mid-height of pipe to at least 95% density. Compact each layer from mid-height of pipe to underside of backfill to at least 90% density. Compact to a width of at least 250mm on each side of the pipe and 200mm over the pipe.

.2 Place backfill material above pipe surround. Use Type 5 fill (pit-run) in layers not more than 200mm in thickness and compact to 95% of the maximum density as determined by the Standard Proctor Compaction Test.

.3 Control moisture content of the backfill material by adding water or drying the material, at the Contractor's expense.

.4 Keep heavy equipment at least 1.5m away from the foundation wall.

.5 Stop type 5 fill at depth required by landscaping. See landscaping specification for the required depth of landscaping materials.

.6 Install 600mm clay cap over granular backfill extending 600mm from foundation wall.

.7 Backfill evenly around structures to minimize unbalanced lateral earth pressure.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-in-Place Concrete

1.2 MEASUREMENT PROCEDURES

.1 Friction Piles:

.1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

1.3 REFERENCES

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

.1 ASTM A36/A36M-05, Standard Specification for Carbon Structural Steel.

.2 ASTM A53/A53M-05, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.2 American Welding Society (AWS)

.1 AWS D1.4/D1.4M-05, Structural Welding Code - Reinforcing Steel.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-04(July 2005), Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA-G30.18-M92(2002), Billet Steel Bars for Concrete Reinforcement.

.3 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.4 CAN/CSA-S16-01(R2007), Limit States Design of Steel Structures.

.5 CSA W48-01(R2006), Filler Metals and Allied Materials for Metal Arc Welding.

1.4 EXISTING CONDITIONS

.1 Sub-surface investigation report has been included as part of this specification. Contractor is to review the report and become familiar with the subsurface conditions.

.2 Notify Contract Administrator in writing if subsurface conditions at site differ from those indicated and await further instructions from Geotechnical Engineer.

1.5 SUBMITTALS

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

.2 Shop Drawings:

.1 Indicate: size of pile, reinforcing steel and ties.

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 Steel casing: As required and designed by installer.

.4 Grout: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.2 SOURCE QUALITY CONTROL

.1 Mill report to CAN/CSA-S16.

.2 Concrete tests: to CSA-A23.1/A23.2.

Part 3 Execution

3.1 INSTALLATION

.1 Friction Piles:

.1 Bore holes to diameters and lengths as indicated. The tips of the piles should not penetrate the glacial till.

.2 Install within 50mm of exact centres set out, 2% of vertical plumb and 25mm of required elevation. Correction of deviations beyond those defined to be at the discretion of the Contract Administrator, costs for correction are to be borne by the Contractor.

.3 Remove loose material, foreign matter and water as directed by geotechnical engineer.

.4 Vibrate top 4500mm of each pile.

.2 Protective steel casing:

.1 Install casing as required. Cost of casing shall be included in lump sum for foundation work.

.3 Remove stones up to 300mm in dimension, boulders over 300mm and rock in whole or in part before boring tool is deflected. If required, lower boring tool and clean hole to ensure that machine auger has reached the required depth.

.4 Check each caisson shaft for toxic and explosive gases and provide appropriate protective measures for personnel working in shaft.

.5 Dispose of excavated materials off site.

.6 Install steel reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing and as indicated.

.7 Fill pile excavations with concrete to elevations as indicated.

.1 Place concrete in one continuous pour in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.8 Steel protective casing may be removed at option of Contractor.

.9 Where steel protective casing is to be removed, provide concrete with minimum slump of 125 mm and with retarder to prevent arching or setting of concrete.

.1 Withdraw casing in conjunction with concrete placing, keeping bottom of casing below level of concrete.

.10 Where steel protective casing is left in place, fill void space between casing and shaft excavation with concrete.

.11 Use tremie pipe or concrete pumping as required. Costs of tremied concrete shall be included in the lump sum for the foundation work.

3.2 PROTECTION

.1 If superimposed work is to be placed later, protect top of each unit with at least 150mm of damp sand.

3.3 DEFECTIVE PILES

.1 Cased concrete shaft piles rejected where:

.1 Soil has entered casing.
.2 Water has entered casing.
.3 Casing is damaged, out of tolerance or alignment.

.2 Defective Friction Piles:

.1 Leave rejected pile in place, place adjacent pile and modify pile cap as directed in writing by Contract Administrator.
.2 No extra compensation will be made for additional piles and other costs due to installation of damaged or defective piles.

3.4 SAFETY

.1 Conform to the latest regulations of the Provincial Building Protection Act and Provincial Building Code and provide all necessary safety equipment required.

3.5 FIELD QUALITY CONTROL

.1 Independent review of friction piling and caisson operations shall be done by an independent inspection and testing agency under a cash allowance and retained by the City.

.2 Maintain accurate records for each caisson and pile installation, including:

.1 Pile size and length, location of pile.
.2 Location.

.3 Top of Caisson Elevation.

.4 Bearing Condition.

.5 Bearing Capacity.

.6 Presence of Water.

.7 Other pertinent information.

.3 Provide Contract Administrator with three copies of records.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Project Clean-Up.

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

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 This Section includes requirements for design, supply and installation of two-post in-ground lifts including safety equipment, controls and accessories.

.2 Ensure that vehicle lifts are fully operational and functioning as intended by the manufacturer and the City, following Substantial Completion.

1.2 SUBMITTALS

.1 Product Data: Manufacturer's data sheets on each product to be used, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Installation methods.

.2 Shop Drawings: Submit drawings showing full layout of all lifts with dimensions and details shown for services and conduits between lifts and the control consoles.

.3 Operation and Maintenance Manual: Submit owner's manual to include system operation, maintenance and troubleshooting, spare part numbers, drawings and schematics.

.4 Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

.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 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.

.3 Hoists Installer Qualifications:

.1 Factory trained authorized company.

.2 Company insured for completed operations of installing lift.

.3 Install in accordance with manufacturer's instructions. Test for proper operation and re- test if necessary until satisfactory results are obtained.

.4 Installation shall be completed in accordance with ANSI/ALI ALIS 2019.

.4 Product Requirements:

.1 Design Standards and Certification: The lifts shall be certified by ETL/Intertek to the ANSI/ALI ALCTV-current edition Standard for Automotive Lifts: Safety Requirements for Construction, Testing and Validation.

.2 The drive system shall permit lifting without any pulsation, jerks, or unsteady lifting. Lifting shall be smooth. System shall be comprised of an electrically

powered pump, flow control valves, and a fluid reservoir. An electronic/hydraulic synchronization system shall ensure smooth alignment of each lifting assembly based on variances in vehicle weight.

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 ready for installation.

.3 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local Authorities Having Jurisdiction.

Part 2 PRODUCTS

2.1 MANUFACTURERS

.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Rotary 70Q-ALI

.2 or approved equal through a substitution approval request.

2.2 PISTON TYPE IN-GROUND LIFTS

.1 Two Post Lift: Lift consists of two (2) lifting units in line with the longitudinal axis of the vehicle, each lifting assembly equipped as to engage the axle and/or suspension as specified. One (1) of the two (2) lifting units is moveable fore and aft to affect variable spacing between lifting units and generally located for the front axle. The other lifting unit is fixed and generally located under the rear axle.

.1 Lifting Capacity:

.1 Lift shall be capable of raising 50,000 lbs. (22,680 kg), 25,000 lbs. (11,340 kg) front post and 25,000 lbs. (11,340 kg) rear post.

.2 Wheel Base Adjustment:

.1 Lifts shall have one motor operated moveable post to accommodate the various wheelbases of the 30 foot and 40 foot buses.

List of buses is provided below under 2.2.4.4

.3 Dimensions:

.1 Front Post shall rise 66 inches (1676 mm) to top of jack assembly

.2 Rear Post shall rise minimum 69 inches (1753 mm) when measured from the finished concrete floor to the underside of the hoist saddle.

.3 Front and Rear Diameter: 10-5/8 inches (270 mm)

.4 Lifting Rate: 90 seconds; 45” (1,140 mm) per minute, minimum.

.5 Moveable and fixed lifting units synchronization: 2” (50 mm).

.4 Lift units:

.1 Units shall consist of frames, pumps, lift posts, a common motor assembly complete with relief valves, and check valves mounted on an appropriately sized hydraulic fluid reservoir. The power unit shall be factory assembled and tested.

.2 Lifts are to be provided with appropriate corrosion protection for an industrial bus repair facility and local environmental factors.

.3 Lifts must be equipped with home pockets for saddles to sit flush with floor surface creating an unobstructed floor, free of tripping hazards

.4 Provide front and rear hoist adapters, supplied for each individual lift, capable of lifting all of Winnipeg Transit buses. The design must be such that all buses can be lifted with a maximum of 2 adapter options for the rear and 2 adapter options for the front.

The various bus makes and models serviced are as follows:

Make	Model	Year
New Flyer	D40	1994
New Flyer	D40-LF	1994
New Flyer	D40-LF	1995
New Flyer	D30-LF	1996
New Flyer	D40-LF	1998
New Flyer	D40-LF	1999
New Flyer	D30-LF	2001
New Flyer	D40-LF	2002
New Flyer	INVERO	2002
New Flyer	D40-LF	2003
New Flyer	D40-LF	2004
New Flyer	D40-LF	2005
New Flyer	D40-LF	2007
New Flyer	D40-LFR	2008
New Flyer	D40-LFR	2009
New Flyer	D40-LFR	2010
New Flyer	D40-LFR	2011
New Flyer	D40-LFR	2012
New Flyer	XE40--LF	2014
New Flyer	XD40--LF	2015
New Flyer	XD40--LF	2016

.5 Unit floor frames shall be structural and have the option to be installed suspended from a thickened slab or on a load bearing foundation slab.

.6 The covers for the moveable lifting unit trench shall be engineered to accept a 7,500 lbs (3,402 kg) point load on a contact area of 2” x 2” (50

mm x 50 mm) as well as a drive- over load 6" x 9" (150 mm x 230 mm tire contact area) of 13,500 lbs./6,124 kg.

.7 Covers shall be flush to finished floor level.

.5 Lift Locks:

.1 Front and rear locking legs shall be rated at same capacity as the corresponding jacking units.

.2 The locking latches shall be spring loaded to the locked position and shall be released at the control location.

.3 The lift locking leg shall be attached to the saddle to prevent rotation insuring proper location of releases at all times. The locking leg shall prevent rotation of the piston assembly.

.6 Controls:

.1 Control system shall conform to all current NEC, UL 201 and OSHA Codes.

.2 Lift controls shall be provided via a remote pendant control and an external wall mounted control console.

.3 External wall mounted control consoles shall be located such that they do not impede on the clear access around each bus required for maintenance personnel, equipment, tools and bus drive-thru exiting.

.4 Current estimate of floor area does not account for potential additional space required for pedestal mounted control consoles.

.7 Certifications:

.1 Hoists must be certified by the ALI, to ANSI-ALCTV.

.2 Installation shall be completed in accordance with ANSI/ALI ALIS 2019.

Part 3 WARRANTY

3.1 Manufacturers Extended Warranty:

.1 Lift system shall be warranted for a minimum period of one year for parts and labour commencing on Substantial Completion, covering repair and/or replacement of equipment or material that causes any operational disturbances due to manufacturing defects or installation defects occurring within the extended warranty period.

3.2 Service

.1 Parts and service within 10km of the City of Winnipeg and a 4-hour response time by a manufacturer certified and authorized technician when called for parts or service for warranty and emergency repairs.

Part 4 COMMISSION

4.1 Testing and Inspection

.1 Once installation is completed, each hoist shall be tested to show fully functionality as per City satisfaction.

.2 A Manufacturer representative shall inspect and approve final installation and operation of the hoists.

4.2 Training

.1 Operators Training shall be provided by Manufacturer representative or authorized agency.

.2 Maintenance Training shall be provided by Manufacturer representative or authorized agency. This training shall include inspection, maintenance and basic repairs of the whole system.

4.3 Manuals

.1 Electronic copies and 2 (two) hardcopies of Operations and Parts and Service manuals shall be supplied.

Part 5 SPARES

5.1 Spares List

.1 Contractor shall provide a detailed list of manufacturer recommended spare parts.

.2 Contractor shall supply a set of spare parts as well as consumable parts such as seals and filters, for the operation of the lifts for the first 12 (twelve) months of operation.

END OF SECTION