

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable. Review submittals prior to submission to Contract Administrator. This review represents that necessary 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.
- .5 Notify Contract Administrator, in writing at time of submission for review, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Verify field measurements and affected adjacent Work are co-ordinated.
- .7 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 The Contractor shall arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, weights, dimensions, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to design Drawings and Specifications. Notify the Contract Administrator in writing of any deviations in Shop Drawings from the requirements of the Contract Documents.
- .3 The Contractor shall examine all Shop Drawings prior to submission to the Contract Administrator to ensure that all necessary requirements have been determined and verified and that each Shop Drawing has been checked and coordinated with the requirements of

the Work and the Contract Documents. Examination of each Shop Drawing shall be indicated by stamp, date and signature of a responsible person of the sub-contractor for supplied items and of the General Contractor for fabricated items. Shop Drawings not stamped, signed and dated will be returned without being reviewed and stamped "Re-submit".

- .4 Submit three (3) copies of white prints and three (3) copies of all fixture cuts and brochures.
- .5 Shop Drawing reviews by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.
- .6 Shop Drawings will be returned to the Contractor with one of the following notations:
 - .1 When stamped "REVIEWED" or "NO EXCEPTIONS TAKEN", distribute additional copies as required for execution of the Work.
 - .2 When stamped "REVIEWED AS MODIFIED" or "MAKE NOTED CORRECTIONS", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".
 - .3 When stamped "REVISE AND RESUBMIT", make the necessary revisions, as indicated, consistent with the Contract Documents and submit again for review.
 - .4 When stamped "NOT REVIEWED" or "REJECTED", submit other Drawings, brochures, etc., for review consistent with the Contract Documents.
 - .5 Only Shop Drawings bearing "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS", or "REVIEWED AS MODIFIED" shall be used on the Work unless otherwise authorized by the Contract Administrator.
- .7 After submittals are stamped "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.
- .8 Any adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.
- .9 Make changes in Shop Drawings, which the Contract Administrator may require, consistent with Contract Documents. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.
- .10 Only two (2) reviews of Shop Drawings will be made by the Contract Administrator at no cost. Each additional review will be charged to the Contractor at the Contract Administrator's scheduled rates. The Contract Administrator's charges for the additional Work will be deducted from the Contractor's Progress Certificates.

- .11 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.

1.3 PROCEDURES

- .1 The Contractor shall, if required by the Contract Administrator, submit for the review of the Contract Administrator method statements which describe in detail, supplement with Drawings where necessary, the methods to be adopted for executing any portion of Work.
- .2 These statements shall also include details of constructional plant and labour to be employed. Acceptance by the Contract Administrator shall not relieve the Contractor of any of his responsibilities, nor shall reasonable refusal to approve entitle the Contractor to extra payment or an extension of time.

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 REFERENCE STANDARDS

- .1 Within the text of the specifications, reference may be made to the following standards:
 - .1 ANSI - American National Standards Institute
 - .2 CEC - Canadian Electrical Code (published by CSA)
 - .3 CEMA - Canadian Electrical Manufacturer's Association
 - .4 CSA - Canadian Standards Association
 - .5 ICEA - Insulated Cable Engineers Association
 - .6 IEEE - Institute of Electrical and Electronic Engineers
 - .7 NBC - National Building Code
 - .8 NEMA - National Electrical Manufacturers Association
 - .9 NETA – InterNational Electrical Testing Association
 - .10 ULC - Underwriters' Laboratories of Canada

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 INSPECTION

- .1 Allow Contract Administrator access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Contract Administrator instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 The Contract Administrator will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, the City shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies may be engaged by the City for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the City. Costs of additional tests required due to defective Work shall be paid by the Contractor.
- .2 All equipment required for executing inspection and testing will be provided by the respective agencies.
- .3 Employment of inspection/testing agencies does not relieve or 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 the Contract Administrator at no cost to the City. Pay costs for retesting and reinspection.

1.3 ACCESS TO WORK

- .1 The City, the Contract Administrator, and other authorities having jurisdiction shall have access to the work.

1.4 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 the 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.

1.5 REPORTS

- .1 Submit three (3) copies of inspection and test reports to Contract Administrator, prior to inclusion with the O&M manuals.

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 CONTRACTOR'S OFFICE

- .1 Accommodation for the Contractor's tools, equipment, and materials shall be the responsibility of the Contractor. Such accommodation at the Site shall be located after consultation with the Contract Administrator. The Contractor shall be responsible for the protection of its plant, tools, equipment, and materials stored on-site. Materials stored on the City's premises shall be neatly stacked and protected from the weather.
- .2 The Contractor shall confine their activities to the minimum area necessary for undertaking and completing the Work. Material and equipment storage areas shall be at locations acceptable to the Contract Administrator.

1.2 LAYDOWN AND STORAGE

- .1 All construction materials shall be stored at designated storage areas. Stored combustible materials shall be separated by clear space to prevent fire spread and allow access for manual fire fighting equipment, including fire hoses, extinguishers, hydrants, etc.
- .2 Pressurized dry chemical fire extinguishers of suitable capacity or equally effective extinguishers as per NFPA 10 shall be provided where:
 - .1 Flammable liquids are stored or handled.
 - .2 Welding or flame cutting is performed.

1.3 TOILETS AND WASHROOMS

- .1 Washroom facilities will be available at the facilities for the Contractor's use.
- .2 The Contractor is responsible for ensuring that the cleanliness of the City washroom facilities is maintained.

1.4 DISPOSAL OF WASTE MATERIALS

- .1 Spoiled and waste materials shall not be dumped, under any circumstances, in any locations other than those approved by the local authorities. Any cost for permits and fees for disposing of waste materials shall be at the Contractor's expense.
- .2 Disposal of all excavated and waste materials shall be in accordance with the requirements of the appropriate provincial regulatory agencies.
- .3 When working anywhere within the Works the Contractor shall at the end of each working day remove the rubbish and leave the Site in a clean and tidy state, to the satisfaction of the Contract Administrator. If this is not done, the City will clean the Site and charge the Contractor.

1.5 PARKING

- .1 The Contractor parking shall be as designated by the Contract Administrator. The parking shall be arranged and maintained so that it does not disrupt the facility's operation and access for the City's operations and maintenance staff.

1.6 USE OF PERMANENT WATER SUPPLY, HEAT, POWER LIGHT, AND TELEPHONE

- .1 The Contractor shall not make use of permanent water supply, heat, power, or telephone inside the City facilities without permission from the Contract Administrator.

1.7 SITE SECURITY

- .1 The Contractor is responsible for all material and equipment stored on the site.

1.8 SCAFFOLDING

- .1 Provide and maintain adequate scaffolding as required. Scaffolding is to be rigid, secure, and constructed to ensure adequate safety for workers. Erect without damage to the building or finishes.
- .2 Scaffolding in accordance with CAN/CSA-S269.2.

1.9 HOISTING

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

1.10 FACILITY ELECTRICAL SUPPLY AND DISTRIBUTION

- .1 If service interruptions are necessary, such interruptions shall be made only at times approved by the City.

1.11 WARNINGS AND TRAFFIC SIGNS

- .1 When Work is performed within public areas, provide and erect adequate warning signs as necessary to give proper warning. Place signs sufficiently in advance to enable public to respond to directions.

- 1.12** Provide and maintain signs and other devices required to indicate construction activities or other temporary or unusual conditions resulting from the Work.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Conform to reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, the Contract Administrator reserves the right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be born by the City in event of conformance with Contract Documents or by the Contractor in event of non-conformance.

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 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. Should disputes arise as to quality or fitness of products, decision rests strictly with the Contract Administrator based upon requirements of Contract Documents.
- .3 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

1.3 Metric Project

- .1 Unless otherwise noted, this project has been designed and is to be constructed in the International System (SI) of Units metric system of measurements.
- .2 During construction, when specified metric elements are unattainable at the time they are required to meet the construction schedule, the Contractor shall notify the Contract Administrator in writing and suggest alternative substitutions. Costs due to these substitutions shall be borne by the Contractor.

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 Remove and replace damaged products at own expense and to satisfaction of the Contract Administrator.
- .5 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 the Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that the Contract Administrator will establish the course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

1.7 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.

1.8 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .4 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .5 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.9 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 the Contract Administrator.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 WORKMANSHIP

- .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 the 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. The Contract Administrator reserves the 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 the Contract Administrator, whose decision is final.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 MATERIALS

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

1.3 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.

1.4 EXECUTION

- .1 Remove and replace defective and non-conforming Work.
- .2 Provide openings in non-structural elements of Work for penetrations of electrical Work.
- .3 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

- .4 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .5 Restore work with new products in accordance with requirements of Contract Documents.
- .6 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .7 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with approved firestopping material, full thickness of the construction element.
- .8 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .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 Furnish evidence, if requested, for type, source and quality of products provided.
- .5 Pay costs of transportation.

1.2 OPERATING AND MAINTENANCE MANUALS

- .1 Prepare using personnel experienced in maintenance and operation of described products.
- .2 Two (2) advance copies of the manuals shall be submitted prior to Substantial Performance of the Work for review and comments. After review, five (5) copies of the final manuals shall be submitted.
 - .1 Four (4) of the copies are to be provided in a single binder.
 - .2 One (1) copy is to be provided in seven binders, with each facility in a separate binder. Each binder shall be organized to be independent of all other binders, as it is intended to be stored in the respective facility with the UPS installation.
- .3 For the guidance of the City's operating and maintenance personnel, the Contractor shall prepare O&M Manuals for the Work, describing in detail the construction of each part of the Work and the recommended procedure for operation, servicing and maintenance.
- .4 All instructions in these manuals shall be in simple language to guide the City in the proper operating and maintenance of this installation.
- .5 Each manual shall contain one section per facility. Each section per facility shall be organized in such a manner to make each section is an independent manual. Duplicate copies of information will be required, when a specific piece of information is applicable to more than one facility.
- .6 In addition to information called for in the Specifications, include the following:
 - .1 Overall Title sheet, labelled "Operation and Maintenance Instructions", and containing project name and date, facility's covered in the manual, City's Contract number, the name and address of the Contractor, and the issue date.
 - .2 Overall list of contents, indicating the facilities upgraded by the project.
 - .3 Title sheet for each section, labelled "Operation and Maintenance Instructions", the applicable facility, and containing project name and date.
 - .4 List of contents for each section.
 - .5 Include:
 - .1 Brochures/catalogue excerpts of all components of the Work.

- .2 Documentation of all test results.
 - .3 Complete set of equipment and assembly drawings
 - .4 Installation, start-up, O&M Manuals
 - .5 Any specific requirements from the Specifications
 - .6 Reviewed Shop Drawings of all equipment.
 - .7 Include sections for the record drawings of all installations. Drafted record drawings of size 432x279mm (11 x 17") will be inserted by others, based on the record drawings marked up by the Contractor.
 - .8 Names, addresses, and telephone numbers of all major sub-contractors and suppliers.
- .7 Modify and supplement the manual as required by the Contract Administrator.
- .8 Format to be as follows:
- .1 Organize data as instructional manual.
 - .2 Binders: vinyl, hard covered, 3 'D' ring, 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 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.3 RECORD DRAWINGS

- .1 After award of Contract, the Contract Administrator will provide a complete set of Drawings for the purpose of maintaining Project Record Drawings. Accurately record deviations from Contract Documents caused by Site conditions and changes ordered by the Contract Administrator. Update daily.
- .2 Identify Drawings as "Project Record Copy". Maintain in good condition and make available for inspection on-site by Contract Administrator at all times.
- .3 On completion of each facility, submit Record Drawings to Contract Administrator for review.

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 GENERAL

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

1.2 CODES AND STANDARDS

- .1 Do complete installation in accordance with CSA C22.1-2006 except where specified otherwise.
- .2 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

1.3 DRAWINGS AND SPECIFICATIONS

- .1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.
- .2 These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.
- .3 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.
- .4 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B4.

1.4 CARE, OPERATION AND START-UP

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

1.5 PERMITS, FEES AND INSPECTION

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

- .2 Pay associated fees.
- .3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.
- .4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.6 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

1.7 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 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.8 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
- .2 Nameplates:
 - .1 Lamicaid 3 mm thick plastic lamicaid nameplates, black face, white core, mechanically attached with self tapping screws.

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
Size 8	35 x 100 mm	3 lines	5 mm high letters

- .3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English.

1.9 WIRING IDENTIFICATION

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

1.10 CONDUIT AND CABLE IDENTIFICATION

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

SYSTEM	Prime Band	Auxiliary Band
347/600V	Dk. Blue	
120/208/240V	Lt. Blue	
UPS System (After UPS)	Lt. Blue	White

1.11 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible, after equipment is installed.

1.12 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and the Contract Administrator.
- .2 Lamicaid 3 mm thick plastic engraving sheet, red face, white core, mechanically attached with self tapping screws, 20mm text.

1.13 OPERATING INSTRUCTIONS

- .1 Provide operating instruction drawing under plexiglass adjacent to each of the UPS installations.
- .2 Drawings: 432 x 279 mm minimum size.

1.14 LOCATION OF OUTLETS

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

1.15 MOUNTING HEIGHTS

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

- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Panelboards: as required by Code or as indicated.

1.16 CONDUIT AND CABLE INSTALLATION

- .1 Sleeves through concrete: schedule 40 galvanized steel pipe, sized for free passage of conduit.
- .2 For wall, partitions, and ceilings the sleeve ends shall be flush with the finish on both sides but for floors they shall extend 100 mm above finished floor level.
- .3 Fire stop opening with ULC approved assembly for the installation conditions.

1.17 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province of Manitoba.

1.18 TESTING

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

1.19 SUBMITTALS

- .1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division
- .2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification.
- .3 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.
- .4 The term "Shop Drawing" means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be

supplied and installed. Indicate cross-references to Design Drawings and Specifications. Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the contract price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.

- .5 Manufacture of Products shall conform to revised Shop Drawings.

1.20 RECORD DRAWINGS

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

- .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 38, Thermoset-Insulated Wires and Cables.
- .3 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.
- .4 CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

1.2 PRODUCT DATA

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

Part 2 Products

2.1 BUILDING WIRES

- .1 Wire: to CAN/CSA-C22.2 No. 28
- .2 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .3 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.
- .4 Colour coding to Section 26 05 01, wires sized 2 AWG and smaller to be factory-coded, taping will not be accepted.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: polyvinyl chloride material.
- .7 Fastenings:
 - .1 One hole malleable iron / steel straps to secure surface cables 50 mm and smaller.
Two hole steel straps for cables larger than 50 mm.

- .2 Channel type supports for two or more cables.
- .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 ACIC/CIC CONTROL CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.
- .2 Conductors, copper, size as indicated.
- .3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 300V.
- .4 Shielding as indicated on the drawings.
- .5 A higher level of shielded cable may be substituted for unshielded, or overall shielded cable, unless otherwise specified, provided that all appropriate shield grounding, as required by the Contract Administrator, is performed. All subsequent related changes, such as required conduit size, fittings, etc are the responsibility of the Contractor.

Part 3 Execution

3.1 GENERAL

- .1 Do not splice cables. A continuous length is required for all feeds.
- .2 Install in accordance with manufacturer's recommendations, observing requirements for minimum bending radius and pulling tensions.

3.2 INSTALLATION OF BUILDING WIRES

- .1 Install in conduit as per Section 26 05 34.

3.3 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Where surface mounted, provide clamps spaced a maximum of 1 m apart, unless otherwise indicated.
- .2 Perform an insulation-resistance test on each conductor, prior to termination, utilizing a megohmmeter with a voltage output of 1000 volts DC. Individually test each conductor with all other conductors and shields grounded. The test duration shall be one minute. Investigate resistances less than 50 megaohms, or deviations between parallel conductors. Conductors with insulation resistance values, at one minute, less than 25 megaohms, or that deviate from other similar conductors by more than 50% will be rejected.

3.4 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground shields at one end only. Where possible, ground shields at the end where power is supplied to the cable. Utilize shield grounding bar in panels, where present.

- .3 Shield drain wires, at the ungrounded end, are to be taped back to the cable. Do not cut the shield drain wire off.
- .4 CIC cable may not be installed in cable tray. Protection in conduit is required over the entire length.
- .5 ACIC cable may be installed in cable tray, provided that:
 - .1 The cable tray does not contain power cables, unless specifically authorized by the Contract Administrator in writing.
 - .2 The ACIC cable voltage rating is equal or greater than the highest voltage contained in the cable tray.

3.5 TERMINATIONS AND SPLICES

- .1 Wire nuts are not permitted on any wiring associated with the UPS system.
- .2 Exercise care in stripping insulation from wire. Do not nick conductors.
- .3 Strictly follow manufacturer's instructions with regards to tool size and application methods of terminations and compounds.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

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

Part 2 Products

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .2 Insulated grounding conductors: green, type RW90.
- .3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install connectors in accordance with manufacturer's instructions.
- .2 Protect exposed grounding conductors from mechanical injury.
- .3 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .4 Use Burndy compression connectors or approved equal for all grounding splices and terminations, unless otherwise indicated.
- .5 Soldered joints not permitted.

3.2 EQUIPMENT GROUNDING AND BONDING

- .1 Install grounding connections to transformers.
- .2 Install bonding connections to all electrical equipment.
- .3 Include a separate green bonding wire in all power conduits including branch circuit wiring sized according to the largest power conductor in the conduit:
 - .1 8 AWG green ground wire for up to 4 AWG power conductors.
 - .2 6 AWG green ground wire for up to 2 AWG power conductors.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 01 – Common Work Results - Electrical

Part 2 Products

2.1 FRAMING AND SUPPORT SYSTEM

- .1 Materials:
 - .1 Conduit support structures shall employ an aluminum strut framing system together with the manufacturer's connecting components and fasteners for a complete system.
- .2 Finishes:
 - .1 Wet locations: Aluminum.
 - .2 Indoors, dry locations: Aluminum.
 - .3 Nuts, bolts, machine screws: Stainless steel.

2.2 CONCRETE AND MASONRY ANCHORS

- .1 Materials: hardened steel inserts, zinc plated for corrosion resistance.
- .2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four.
- .3 Manufacturer: Hilti (Canada) Limited or approved equal.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with galvanized anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten conduit to building construction or support system at intervals of 2.5m or less, unless otherwise noted.
- .6 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

- .7 Ensure adequate support for raceways and cables dropped vertically where there is no wall support.
- .8 Do not use wire lashing or perforated strap to support or secure cables.
- .9 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 SECTION INCLUDES

- .1 Materials and components for splitters, junction, pull boxes, and cabinets.

1.2 RELATED SECTIONS

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.76, Splitters

Part 2 Products

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Three sets of lugs, minimum.
- .3 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .4 Main lugs rated a minimum of 225A, branch lugs rated a minimum of 150A.
- .5 Provide ground bar, with a minimum of three terminals.

2.2 JUNCTION AND PULL BOXES

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

Part 3 Execution

3.1 SPLITTER INSTALLATION

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

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.

- .2 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Install size 3 identification labels indicating system voltage, phase, and source of feed.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (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 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
- .6 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

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.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Utilize insulated grounding bushings at all enclosure entries.
- .3 Watertight connectors and couplings for EMT, where not in electrical or control room spaces. Set-screws are not acceptable.

Part 3 Execution

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Use rigid galvanized steel threaded conduit except where specified otherwise for SCADA wiring.
- .3 Use liquid tight flexible metal conduit for connection of power conductors to UPS units and transformers.
- .4 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .5 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .6 Do not include more than the equivalent of four (4) quarter bends. Provide pull boxes as required.
- .7 Ensure electrical continuity in all conduit systems.
- .8 All conduit shown exposed in finished areas is to be free of unnecessary labels and trade marks.
- .9 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant. Seal all conduits entering or leaving hazardous classified areas with approved seals.
- .10 Where conduits pass through walls, group and install through openings. After all conduits shown on the Drawings are installed, close wall openings with material compatible with the wall construction.

3.2 SURFACE CONDUITS

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Requirements for system testing.

1.2 RELATED SECTIONS

- .1 Section 26 05 01 - Common Work Results - Electrical.

Part 2 Products

- .1 Not Applicable.

Part 3 Execution

3.1 GENERAL

- .1 The testing specified in this section does not relieve any testing requirements of individual components, specified in other sections.
- .2 Perform these tests prior to energization of equipment.
- .3 The duration for insulation resistance tests shall be one minute.
- .4 Record all measurements.

3.2 DEACON CHEMICAL FEED BUILDING

- .1 UPS-C1 Input System Test
 - .1 XFMR-C3 secondary wiring is to be disconnected.
 - .2 BKR-C3 is to be closed.
 - .3 DS-UPS-C1 is to be closed.
 - .4 UPS-C1 input wiring is to be disconnected.
 - .5 MTS-C1 is to be in the UPS position, with a temporary ground attached to the MTS-C1 output terminals.
 - .6 Perform an insulation resistance test, at 500 VDC, of the wiring and equipment from the secondary wiring of XFMR-C3 to the input of the UPS.
 - .7 Perform a low resistance ohmmeter measurement of the system from the secondary wiring of XFMR-C3 to the input of the UPS.
- .2 UPS-C1 Output System Test
 - .1 UPS-C1 output wiring is to be disconnected.
 - .2 MTS-C1 is to be in the UPS position, with a temporary ground attached to the MTS-C1 bypass input terminals.
 - .3 XFMR-C4 primary wiring is to be disconnected.

- .4 Perform an insulation resistance test, at 500 VDC, of the wiring and equipment from the output of the UPS to the primary wiring of XFMR-C4.
- .5 Perform a low resistance ohmmeter measurement of the system from the output of the UPS to the primary wiring of XFMR-C4.

3.3 DEACON BOOSTER PUMPING STATION

- .1 UPS-D1 Input System Test
 - .1 XFMR-D18 secondary wiring is to be disconnected.
 - .2 BKR-D18 is to be closed.
 - .3 DS-UPS-D1 is to be closed.
 - .4 UPS-D1 input wiring is to be disconnected.
 - .5 MTS-D1 is to be in the UPS position, with a temporary ground attached to the MTS-D1 output terminals.
 - .6 Perform an insulation resistance test, at 500 VDC, of the wiring and equipment from the secondary wiring of XFMR-D18 to the input of the UPS.
 - .7 Perform a low resistance ohmmeter measurement of the system from the secondary wiring of XFMR-D18 to the input of the UPS.
- .2 UPS-D1 Output System Test
 - .1 UPS-D1 output wiring is to be disconnected.
 - .2 MTS-D1 is to be in the UPS position, with a temporary ground attached to the MTS-D1 bypass input terminals.
 - .3 XFMR-D19 primary wiring is to be disconnected.
 - .4 Perform an insulation resistance test, at 500 VDC, of the wiring and equipment from the output of the UPS to the primary wiring of XFMR-D19.
 - .5 Perform a low resistance ohmmeter measurement of the system from the output of the UPS to the primary wiring of XFMR-D19.

3.4 TACHE BOOSTER PUMPING STATION

- .1 UPS-1 Input System Test
 - .1 Transformer (10 kVA) secondary wiring is to be disconnected.
 - .2 BKR-10 is to be closed.
 - .3 DS-UPS-1 is to be closed.
 - .4 UPS-1 input wiring is to be disconnected.
 - .5 MTS-1 is to be in the UPS position, with a temporary ground attached to the MTS-1 output terminals.
 - .6 Perform an insulation resistance test, at 500 VDC, of the wiring and equipment from the secondary wiring of the 10 kVA transformer to the input of the UPS.
 - .7 Perform a low resistance ohmmeter measurement of the system from the secondary wiring of the 10 kVA transformer to the input of the UPS.
- .2 UPS-1 Output System Test
 - .1 UPS-1 output wiring is to be disconnected.
 - .2 MTS-1 is to be in the UPS position, with a temporary ground attached to the MTS-1 bypass input terminals.

- .3 XFMR-11 primary wiring is to be disconnected.
- .4 Perform an insulation resistance test, at 500 VDC, of the wiring and equipment from the output of the UPS to the primary wiring of XFMR-11.
- .5 Perform a low resistance ohmmeter measurement of the system from the output of the UPS to the primary wiring of XFMR-11.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

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

1.3 REFERENCES

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

1.4 PRODUCT DATA

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

Part 2 Products

2.1 TRANSFORMERS

- .1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2 No.47.
- .2 Design 1 – 600V Input.
 - .1 Type: ANN.
 - .2 Single phase, kVA as indicated, 600V input, 120/240 V output, 60 Hz.
 - .3 Voltage taps: 2.5% full capacity above and below normal.
 - .4 Windings: copper.
 - .5 Insulation: Class H, 220°C.
 - .6 Temperature rise: 115°C at continuous full load.
 - .7 Basic Impulse Level (BIL): 10 kV.
 - .8 Hipot: 4kV.
 - .9 Average sound level: To meet the local municipal & building codes and meet at minimum the following criteria:
 - 45 dB max. up to 45 kVA
 - 50 dB max. up to 150 kVA
 - .10 Impedance at 170 degrees C: standard
 - .11 Enclosure: as indicated in Schedule 261217-1.

- .12 Mounting: as indicated on the drawings.
 - .13 Nameplate to include actual transformer impedance (%Z).
 - .14 Finish: in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .3 Design 2 – 240V Input.
- .1 Type: ANN.
 - .2 Single phase, kVA as indicated, 240V input, 120/240 V output, 60 Hz.
 - .3 Voltage taps: 2.5% full capacity above and below normal.
 - .4 Windings: copper.
 - .5 Insulation: Class H, 220°C.
 - .6 Temperature rise: 115°C at continuous full load.
 - .7 Basic Impulse Level (BIL): 10 kV.
 - .8 Hipot: 4kV.
 - .9 Average sound level: To meet the local municipal & building codes and meet at minimum the following criteria:
 - 45 dB max. up to 45 kVA
 - 50 dB max. up to 150 kVA
 - .10 Impedance at 170 degrees C: standard
 - .11 Enclosure: as indicated in Schedule 261217-1.
 - .12 Mounting: as indicated on the drawings.
 - .13 Nameplate to include actual transformer impedance (%Z).
 - .14 Finish: in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Label size: 7.
- .3 Indicate equipment identifier, KVA rating, primary and secondary voltage.

Part 3 Execution

3.1 INSTALLATION

- .1 Mount dry type transformers up to 75 kVA as indicated on the drawings. Provide brackets and bolts for wall mounted transformers. Ensure all transformers have good ventilation.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.

- .6 Make primary and secondary connections in accordance with wiring diagram.
- .7 Mount transformers to reduce direct and transmitted noise. Mount core and coils of transformers.
- .8 Make connections to transformers in flexible conduit, entering the enclosure below the coils.
- .9 Energize transformers after installation is complete.
- .10 Adjust tap connections to give a continuous secondary voltage of 120 volts phase to neutral, under load.

3.2 TESTING

- .1 Perform an insulation-resistance test. Individually test each winding with all other windings grounded, and test winding to winding, with both windings ungrounded. The test voltage shall be 1000 VDC, unless otherwise indicated by the manufacturer. The test duration shall be one minute.
- .2 Measure and record the voltage on the primary and secondary of the transformer. Adjust the tap position as required. Record final tap position and voltage.

Schedule 261217-1 : Transformers

Identifier	Location	Size	Voltage	Enclosure Type
Deacon Chemical Feed Building				
XFMR-C3	Electrical Room	10 kVA	600:120/240V, 1Ø	CSA 1
XFMR-C4	Electrical Room	10 kVA	240:120/240V, 1Ø	CSA 1
Deacon Booster Pumping Station				
XFMR-D18	Discharge Header Walkway	25 kVA	600:120/240V, 1Ø	CSA 3R
XFMR-D19	Control Room	15 kVA	240:120/240V, 1Ø	CSA 1

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

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

1.3 REFERENCES

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

1.4 SHOP DRAWINGS

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

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 240V panelboards: bus and breakers rated for 10 kA (symmetrical) interrupting capacity, or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two (2) keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating as mains.
- .7 Trim with concealed front bolts and hinges.
- .8 Trim and door finish: baked grey enamel.
- .9 Enclosure: 508mm (20") wide

- .10 Provide and install additional insulated isolated ground bar assembly.
 - .1 PNL-D19, isolated ground bar assembly to contain 15 terminals.
 - .2 PNL-D20: isolated ground bar assembly to contain 23 terminals.
- .11 Panelboards to be Square D NQOD series.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 8 engraved as follows:
 - .1 Line 1 is to be the panel identifier as indicated on the drawings, for example "PNL-D20".
 - .2 Line 2 is to be the voltage, for example "120/240V, 1Ø".
 - .3 Line 3 is to be labelled "Fed By UPS-D1".
- .3 Complete circuit directory with typewritten legend.
- .4 Lamicaid labelled "ISOLATED GROUND" to be installed adjacent to isolated ground assembly.
- .5 Provide a label with the following wording:

WARNING
Arc Flash and Shock Hazard
Appropriate Personal Protection Equipment Required

- .1 The word "WARNING" is to be black, with an orange background.
- .2 The remaining text is to be black, on a white background
- .3 The label is to be 125mm wide by 90mm high.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height of two (2) metres to top of cover, as required by Code, or as indicated.

.4 Connect loads to circuits.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers and circuit breakers.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

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

1.4 SUBMITTALS

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

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers, and Circuit breakers to CSA C22.2 No. 5
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers to have minimum 10kA symmetrical rms interrupting capacity rating.
- .5 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.
- .6 Include:
 - .1 On-off locking device.
 - .2 Neutral and Ground bus bars, fully rated.
- .7 Individual breakers, not in panelboards, are to be Square D FAL series.
- .8 Breakers in Square D NQOD panelboards are to be Square D QOB bolt-on breakers.
- .9 Breakers in Square D QO series enclosures are to be Square D QO breakers.

2.2 ENCLOSURE FOR INDIVIDUALLY MOUNTED BREAKERS

- .1 Enclosures are to be Type 1 surface mounted, front mounted external operating handle, lockable in the “off” position with a padlock.
- .2 Provide neutral bar, with ampere rating equal or greater than the breaker rating.
- .3 Provide ground bar with a two (2) terminals.

2.3 ACCESSORIES

- .1 All main and branch breakers in PNL-D19 are to include a permanently fixed attachment for padlocking the breakers in the OFF position.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.
- .2 Identification: In accordance with Section 26 05 01 – Common Work Results – Electrical, provide lamicoid plate on or adjacent to each breaker showing load being fed. Example: “PNL-D20”.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

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

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4, Enclosed Switches.

1.4 SUBMITTALS

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

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Non-fusible, disconnect switch in CSA Enclosure Type 1, to CAN/CSA C22.2 No.4, size as indicated.
- .2 Provision for padlocking in the OFF switch position.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Quick-make, quick-break action.
- .5 ON-OFF switch position indication on switch enclosure cover.
- .6 Neutral and ground bars, with a minimum ampere rating equal to the disconnect switch.
- .7 All disconnect switches to be Square D.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Indicate equipment identifier, as shown on the drawings, on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches.
- .2 Connect line and load cables to all disconnect switches.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Both single and three phase Uninterruptible Power Systems (UPS).

1.2 RELATED SECTIONS

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

1.3 SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include:
 - .1 Schematic diagram showing interconnection of components.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide data for incorporation into operation and maintenance manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Manual to include:
 - .1 Operation and maintenance instructions concerning design elements, construction features, component functions and maintenance requirements to permit effective operations maintenance and repair.
 - .2 Technical data:
 - .1 Approved shop drawings.
 - .2 Project data.
 - .3 Technical description of components.
 - .4 Parts lists with names and addresses of suppliers.

1.5 SYSTEM START-UP

- .1 Provide factory authorized service personnel to supervise start-up of system, checking, adjusting and testing on site.

1.6 TRAINING

- .1 Provide one training session for City electrical maintenance personnel, at a location arranged by the Contract Administrator.
- .2 Instruct City personnel on theory, construction, installation, operation and maintenance of the UPS installations.

Part 2 Products

2.1 UNINTERRUPTIBLE POWER SYSTEM

- .1 Provide as per Schedule 263353-1.
- .2 Alternatives must be approved as per B6 of the Bidding Procedures.
- .3 Conformance with CSA C22.2, No. 107.3.
- .4 Listed with cUL.
- .5 Technology:
 - .1 Online, double-conversion, split-phase topology with static bypass switch.
 - .2 Frequency independent operation.
- .6 Input power:
 - .1 Single phase (240V) or Three phase (208V) as per Schedule 263353-1
 - .2 Grounded neutral, 60 Hz.
 - .3 Normal supply from ac mains.
 - .4 Emergency supply from standby generator unit.
- .7 Output power:
 - .1 Single phase (240V) or Three phase (208V) as per Schedule 263353-1
 - .2 Grounded neutral, 60 Hz.
 - .3 Full load output at 0.9 power factor lagging..
 - .4 Overload capability: 110% of rated full load current at 0.9 power factor and rated voltage for 10 min.
 - .5 Frequency - nominal 60 Hz:
 - .6 Output voltage control:
 - .1 Voltage regulation: voltage not to change by more than 2% as load increases gradually from zero to 100%, or for specified duration of full load after mains failure.
 - .2 Transient voltage change not to exceed +/-10% of rated voltage upon 50% sudden load change, loss or return of ac input voltage to system when fully loaded or transfer of full load from inverter to bypass and vice versa, and return to normal within 3 Hz.
 - .3 Harmonics over entire load range:
 - .1 Total Harmonic Distortion (THD) to exceed 5% for linear loads.
 - .2 Total Harmonic Distortion (THD) to exceed 2% for non-linear loads.
 - .7 Efficiency: Overall system efficiency at rated load with battery fully charged not less than 90 %.
 - .8 Interference suppression:
 - .1 If UPS equipment generates electromagnetic rf interference at levels which adversely affects other equipment in vicinity, install suppression circuits or shielding as required to eliminate such interference.

- .2 If harmonics reflected back to mains from rectifier adversely affect other loads connected to same bus, install suppression circuits to prevent that condition.
- .8 The unit will have an internal automatic bypass switch that will operate automatically upon any fault, internal to the UPS, and allows the unit to switch to the internal bypass seamlessly. This requirement also assumes the units input and output power when the unit is in "normal" operation will be in phase.
- .9 The UPS shall have provision for battery status monitoring, which shall include automatic battery tests on a scheduled basis, and be able to report on battery life remaining (estimate), total number of discharges, total time in discharge. The power to the load of the unit shall be completely protected from unanticipated battery failure during these tests.
- .10 The UPS shall have controls mounted in panel front.

2.2 WALL MOUNTED BYPASS SWITCH

- .1 Provide as per Schedule 263353-1.
- .2 CSA approved or contains an equivalent listing acceptable to the inspection authority.
- .3 Rated at 240V AC, 125A.
- .4 Make-before-break switch with UPS, Line, Service, and Off Positions.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate UPS cabinets and associated extended battery modules as indicated on the drawings.
- .2 Install and configure all option cards.
- .3 Assemble and interconnect components to provide complete UPS as specified.
- .4 Connect ac mains to main input terminal.
- .5 Connect UPS output to load.
- .6 Start-up UPS and make preliminary tests to ensure satisfactory performance. Do not power UPS without factory authorized service personnel present.
- .7 Perform the installation as per the Manufacturer's O&M manual, except where indicated otherwise in the drawings or Specifications.

- .8 Set the UPS Battery Load Alarm Level to 1.990 V/cell.

3.2 TESTING

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Test equipment:
 - .1 Instruments used during testing, are to have been calibrated within one year prior to the test date.
 - .2 Load bank for testing, adjustable to 110 % of system rated output power.
- .3 Provide:
 - .1 Competent field personnel to perform test, adjustments and instruction on UPS equipment.
- .4 Visual inspection to determine:
 - .1 Materials, workmanship, and assembly conform with design requirements.
 - .2 Parts are new and free of defects.
 - .3 Battery and components are not damaged.
 - .4 Battery cells are of identical construction.
 - .5 Each battery cell polarity and polarity of connections to inverter are correct.
 - .6 Accessories are present.
- .5 Demonstrate System Operation:
 - .1 System start-up and shut down.
 - .2 System switchover to and from internal and external bypass.
 - .3 Adjustable settings.
- .6 UPS Measurement Test:
 - .1 Test and record all UPS internal measurements against calibrated test instruments for 50% and 100% output load. The tests shall include:
 - .1 Output voltage, current, frequency, and power.
 - .2 Battery voltage and current.
 - .3 Input voltage, current, and power.
 - .4 Bypass voltage and frequency.
- .7 Steady Load Test:
 - .1 Switch system onto ac mains, start UPS and connect load bank at UPS rated load.
 - .2 Operate system at full rated load for one (1) hour.
 - .3 Record data, utilizing UPS display, at start of test and every 10 minutes thereafter, including:
 - .1 Output voltage phase to phase, phase to neutral.
 - .2 Output current each phase.
 - .3 Output frequency.
 - .4 Output kW.
 - .5 Battery voltage and current

- .8 Battery Testing:
 - .1 Charge battery to ensure cells are fully charged. When voltage reaches steady value at end of charge, record:
 - .1 Ambient temperature.
 - .2 Temperature of each cell.
 - .3 Voltage of each cell.
 - .4 Voltage of overall battery string.
 - .5 Charger output voltage and current.
 - .6 AC ripple current and voltage imposed on the battery.
 - .7 Internal ohmic values of each cell and battery.
 - .8 Measure intercell connection resistances for all cells.
- .9 Battery Load Test
 - .1 Charge battery to ensure cells are fully charged.
 - .2 Set the UPS Battery Load Alarm Level to 1.750 V/cell for the battery load test.
 - .3 Connect the load bank to the UPS output, configured for the UPS rated output power.
 - .4 Record data, utilizing UPS display, at start of test and every 5 minutes thereafter, including:
 - .1 Output voltage phase to phase, phase to neutral.
 - .2 Output current each phase.
 - .3 Output frequency.
 - .4 Output kW.
 - .5 Battery voltage and current
 - .5 Upon the Battery Low Alarm, record:
 - .1 The test time expired.
 - .2 Battery voltage and current.
 - .6 Allow the UPS to automatically shutdown on low battery. Record the time of automatic shutdown.
 - .7 Reset the UPS Battery Load Alarm Level to 1.990 V/cell.
- .10 SCADA Alarms
 - .1 With the assistance of City of Winnipeg personnel, test the UPS alarms transmitted to the PLC/SCADA system.

Schedule 263353-1 : UPS Device List

Qty	Description	Model
Shoal Lake Intake		
1	Three-phase UPS, 10 kVA, 2-High with 32 internal batteries, 208V	Powerware 9355 with 32-battery, 10 kVA, 208V
2	Extended Battery Module, 2-High	Powerware 9355 EBM 64
1	SNMP Card	Powerware ConnectUPS-X Web/SNMP/xHub Card

Qty	Description	Model
1	Alarm Interface Card	Powerware Relay Interface Card
Deacon Chemical Feed Building		
1	Single-phase UPS, 8 kVA, 3-High, 240V	Powerware 9155 Model 8 – 64 battery
1	SNMP Card	Powerware ConnectUPS-X Web/ SNMP/xHub Card
1	Alarm Interface Card	Powerware Relay Interface Card
1	Wall-mounted Bypass Switch, 240V, 125A, make-before-break	Powerware Wall-mounted Maintenance Bypass Module for Powerware 9155
Deacon Booster Pumping Station		
1	Single-phase UPS, 15 kVA, 3-High, 240V	Powerware 9155 Model 15 – 64 battery
1	Extended Battery Module, 3-High	Powerware 9155 EBM 96
1	SNMP Card	Powerware ConnectUPS-X Web/ SNMP/xHub Card
1	Alarm Interface Card	Powerware Relay Interface Card
	Wall-mounted Bypass Switch, 240V, 125A, make-before-break	Powerware Wall-mounted Maintenance Bypass Module for Powerware 9155
MacLean Pumping Station		
1	Alarm Interface Card	Powerware Relay Interface Card
McPhillips Pumping Station		
1	Single-phase UPS, 10 kVA, 3-High, 240V	Powerware 9155 Model 10 – 64 battery
1	Extended Battery Module, 3-High	Powerware 9155 EBM 96
1	SNMP Card	Powerware ConnectUPS-X Web/ SNMP/xHub Card
1	Alarm Interface Card	Powerware Relay Interface Card
Hurst Pumping Station		
1	Single-phase UPS, 10 kVA, 3-High, 240V	Powerware 9155 Model 10 – 64 battery
1	Extended Battery Module, 3-High	Powerware 9155 EBM 96
1	SNMP Card	Powerware ConnectUPS-X Web/ SNMP/xHub Card
1	Alarm Interface Card	Powerware Relay Interface Card

Qty	Description	Model
Tache Booster Pumping Station		
1	Single-phase UPS, 8 kVA, 3-High, 240V	Powerware 9155 Model 8 – 64 battery
1	SNMP Card	Powerware ConnectUPS-X Web/ SNMP/xHub Card
1	Alarm Interface Card	Powerware Relay Interface Card
	Wall-mounted Bypass Switch, 240V, 125A, make-before-break	Powerware Wall-mounted Maintenance Bypass Module for Powerware 9155

END OF SECTION