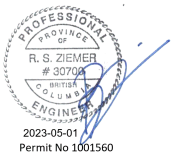
NRS ENGINEERING LTD
Consulting Electrical Engineers

NORTHERN HEALTH AUTHORITY
UHN TRAYLINE ASSEMBLY SYSTEM REPLACEMENT

ELECTRICAL SPECIFICATIONS
INDEX



1 GENERAL

1.1 GENERAL CONDITIONS

1.1.1 All clauses set forth in the Bidding Requirements, General and Supplementary General Conditions and Division 1 - General Requirements, apply to and govern this Section
and all other Sections under Division 26, 27, 28.

1.1.2 All Sections of Division 26, 27, 28 are to be read and taken together and to be read and taken with reference to the drawings and specification sections of other Divisions.

1.1.3 All equipment and installation shall comply with Canadian Electrical Code C22.1, current edition as modified for use in British Columbia, together with all directives, bulletins and amendments by Authorities having jurisdiction over the work and any local bylaws.

1.2 DEFINITIONS

1.2.1 The following are definitions of terms and expressions used in this specification.

1.2.1.1 "Engineer" means an authorized representative of NRS Engineering Ltd.
1.2.1.2 "Provide" means that the so noted item is to be supplied and installed and placed in working order.
1.2.1.3 “Install” means all work and material necessary to place the specified item into full operation, securely fastened and to give a presentable finished appearance. “Install” also includes all necessary connections and conductors.
1.2.1.4 “Owner” means the School District No. 54.
1.2.1.5 “Coordinate” means to make all arrangements directly with agencies and individuals, confirm schedules, be in attendance at the time work is carried out, take full responsibility for having the work carried out correctly and in a timely manner to meet the construction schedule.
1.2.1.6 “Engineer Approved Equal” means that the product, method or practice has been approved in writing by the Engineer, prior to installation.

1.3 SCOPE OF WORK

1.3.1 This specification is a dynamic document and is project specific. It is the responsibility of the Contractor to become familiar with this document and not to assume that all clauses are identical to specifications of other projects.

1.3.2 This Section includes the supply and installation of all electrical materials and equipment to provide complete and operative electrical systems.

1.3.3 The Contractor shall provide all labour, materials, tools and equipment required for the work, except such materials and/or equipment that may be specified as supplied by the Owner or by others.

1.3.4 It is the intent of the drawings and specifications to provide a complete and workable installation. Any work, fitting and/or necessary material not specifically mentioned or shown on the plans, but obviously necessary to complete the installation, shall be furnished by the Contractor as if specifically mentioned herein and detailed.

1.3.5 Work shall include but not be limited to:

1.3.5.1 All permits and licenses.

1.3.6 Whenever systems are being upgraded and/or installed, all abandoned cabling and devices shall be removed.

1.3.7 Provision of new electrical panel and feeder for new trayline equipment.

1.3.8 Power supply for new equipment as noted on the drawings

1.3.9 Review and note after works as required in contract for changeover during phases of project or off-peak hours work to avoid kitchen staff.

1.3.10 Temporary trayline equipment to powered using SOW cable suspended along wall below T-bar ceiling. After changeover to permanent location, cabling and supports to be removed and turned over to FM for future use.

1.3.11 Infection control as per total project specifications.

2 PRODUCTS

2.1 SELECTED PRODUCTS & EQUIVALENTS

2.1.1 Selected products are specified and/or shown on the drawings and identified by manufacturer's name, type and catalogue number.

2.1.2 The tender shall be based on the use of only these selected products.

2.1.3 Applications for approval of alternate material will not be considered during the tender period.

2.1.4 Where a number of pre-approved manufacturers are listed, the product supplied must be equal in every respect to the product specified, including all options and accessories provided for in the part number or catalogue number given.

2.2 REVIEW OF PRODUCTS

2.2.1 Immediately after notification of award of contract, review with the Engineer, a list of products proposed and any proposed cost saving substitution. Substitutions will be

accepted or rejected at the sole discretion of the Engineer.

2.2.2 After approval of product list, no subsequent changes will be permitted except as specified hereunder.

2.2.3 It is imperative that this process occurs prior to site excavations to ensure all coordination is properly completed.

2.3 SUBSTITUTION OF PRODUCTS

2.3.1 After approval of the list of products, no substitution of any item will be permitted unless the approved item cannot be delivered to the job site in time to comply with the work schedule.

2.3.2 To receive approval, proposed substitutes must equal or exceed the quality, finish and performance of those specified and/or shown and must not exceed the space requirements allotted on the drawings.

2.3.3 Provide documentary proof of equality, difference in price (if any) and delivery dates in the form of certified quotations from suppliers of both specified items and proposed substitutions to the Engineer.

2.3.4 Include costs for any required revisions to other structures and products to accommodate such substitutions, including work of other Divisions.

2.4 QUALITY OF PRODUCTS

2.4.1 All products provided shall be approved by CSA or other accredited testing and certification organization or carry equivalent approval acceptable to the BC Inspection Authority and shall be new, unless otherwise specified. All fire alarm equipment shall be ULC approved.

2.4.2 If products are not approved as in 2.4.1, obtain approval of provincial inspection authority or submit directly to CSA or other BC accredited testing and certification organization for approval. Pay all applicable charges levied and make all modifications required for approval.

2.4.3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and their use subject to approval by the Engineer.

2.5 UNIFORMITY OF MANUFACTURE

2.5.1 Unless otherwise specifically called for in the Specifications, uniformity of manufacture shall be maintained for similar products throughout the work.

2.6 PRODUCT FINISH

2.6.1 Finish all cabinets, panelboards, switchboards, equipment cabinets, cable trays, etc., in ANSI 61 grey enamel unless otherwise specified. Items in public view to be white.

2.6.2 Apply primer on all items which are to be finished on the job site.

2.6.3 Touch up all damaged painted finishes with matching lacquer, or if required by the Engineer, completely repaint damaged surfaces at no additional cost to the Owner.

2.7 PRODUCT HANDLING

2.7.1 Use all means necessary to protect the products of this Division before, during and after installation and to protect products and installed work of other trades.

2.7.2 Immediately make good any damage by repair or replacement at no additional cost to the Owner and to the approval of the Engineer.

2.7.3 Remove shipping labels from fixtures, conduit, panelboards, etc.

2.7.4 Remove dirt, rubbish, grease, etc., resulting from this work from all surfaces.

3 EXECUTION

3.1 SITE EXAMINATION

3.1.1 Examine the site of work and become familiar with all features and characteristics affecting this work before submitting tender.

3.1.2 No additional compensation will be given for extra work due to existing conditions which such examinations should have disclosed.

3.1.3 Report to the Engineer any unsatisfactory conditions which may adversely affect the proper completion of this work.

3.1.4 Not all existing equipment, that may require relocation or removal, is shown on the drawing. The Contractor shall thoroughly examine the site before submitting tender.

3.1.5 Before beginning any work all existing underground utilities are to be located and marked to avoid injury or damage.

3.2 COORDINATION WITH OTHER DIVISIONS

3.2.1 Examine the drawings and specifications of all divisions of the Project. Before commencing work, obtain a ruling from the Engineer if any conflict exists; otherwise no additional compensation will be made for any necessary adjustments.

3.2.2 Install anchors, bolts, pipe sleeves, hanger inserts, etc., in ample time to prevent delays. Core drill all holes in advance of electrical work.

3.2.3 Lay out the work and equipment with due regard to architectural, structural and mechanical features and so as to fit within the designated areas.

3.2.4 Do not cut structural members without approval of the Engineer.

3.2.5 Examine previously constructed work and notify the Engineer of any conditions which prejudice the proper completion of this work. Commencement of this work without such notification shall constitute acceptance of other work.

3.2.6 Coordinate with the other Divisions to ensure that the electrical characteristics of equipment supplied by them (as shown on the approved shop drawings and/or equipment nameplates) matches the electrical characteristics indicated on the electrical drawings. Advise the Engineer of any discrepancies and provide all electrical equipment to match the equipment supplied.

3.3 SEPARATION OF SERVICES

3.3.1 Maintain separation between electrical wiring system and building piping, ductwork, etc., so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion or other adverse condition.

3.3.2 In particular, contact between dissimilar metals, such as copper and aluminum in damp or wet locations is not permitted.

3.3.3 Communication circuits must be adequately separated from power conductors to prevent noise or other interference.

3.3.4 Do not support wiring from pipes, ductwork, etc. Use only approved supports.

3.4 LOCATION OF OUTLETS & FIXTURES

3.4.1 Electrical drawings are, unless otherwise indicated, drawn to scale, figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, on-site measurements shall be undertaken by the Contractor.

3.4.2 Outlet and equipment locations shown on the drawings are approximate. Locations may be revised at the direction of the Engineer by not more than 3000mm to suit construction and equipment arrangement without additional cost to the Owner, provided that installation has not been completed.

3.4.3 Maintain lighting fixture locations wherever possible and notify the Engineer of conflicts with other services.

3.4.4 Install surface mount fixtures clear of overhead doors or similar obstructions.

3.5 IDENTIFICATION

3.5.1 Provide engraved lamicoid nameplates with 6mm black lettering on white background with approved wording on all motor starters, disconnect switches (other than in panelboards), switchgear, panels and on other electrical equipment where needed to aid servicing and upkeep and to inform maintenance staff. (Refer to Specification

Section 26 05 53).

3.5.2 Clearly mark all exposed conduit, pullboxes, junction boxes, etc., to indicate the nature of service.

3.5.3 Provide neatly typed circuit directories on panelboards utilized on the project to indicate the area or equipment controlled by each branch circuit.

3.5.4 All fire alarm junction boxes, blank outlet cover boxes and conduit that passes through floors shall be painted red. Paint all new conduit for 12" above and below floor penetrations.

3.6 INSTRUCTIONS TO OWNER'S PERSONNEL

3.6.1 Instruct Owner's personnel in operation and maintenance of electrical equipment and systems and provide the Engineer with satisfactory proof of such instruction.

3.7 MOUNTING OF ELECTRICAL EQUIPMENT

3.7.1 The Contractor shall provide all required mounting hardware, supports, brackets and similar equipment required to firmly attach all equipment provided to the locations shown on the drawings.

3.7.2 All devices recessed in T-bar ceilings shall be mounted with Commander-Iberville 1041 or 1042 bar hangers, or approved equal.

3.7.3 Wherever possible the Contractor shall utilize manufacturer approved and supplied mounting hardware. Where custom fabricated hardware is provided by the Contractor, he shall review the proposed installation method with the Engineer prior to installation and shall provide shop drawings where required.

3.7.4 All mounting hardware shall seismically restrain the electrical equipment and prevent injury to persons in and around the building during an earthquake.

3.7.5 The Contractor shall provide documentation from the manufacturer or a registered Professional Engineer indicating that the proposed seismic restraints comply fully with the BC Building Code, accepted practice and sound engineering principles.

4 OTHER REQUIREMENTS

4.1 DRAWINGS & SPECIFICATIONS

4.1.1 The intent of the drawings and specifications is to include all labour, products and services necessary for complete work, tested and ready for operation.

4.1.2 The drawings and specifications are complementary and what is required by any one shall be as binding as if required by all.

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

4.1.4 If discrepancies or omissions in the drawings or specifications are found, or if intent or meaning is not clear, advise the Engineer for clarification before submitting tender.

4.1.5 Responsibility to determine which Division provides various products and work rests with the Contractor. Additional compensation will not be considered because of difference in interpretation of specifications.

4.1.6 All work shown on the Division 26, 27, 28 drawings and contained in Division 26, 27, 28 specifications is to be performed under the contract. Alert the General Contractor and assist other Divisions to perform all work indicated that cannot be performed by this Contractor. Contractor to coordinate and pay for the work of other Divisions where noted on the drawings.

4.2 CODES, PERMIT & FEES

4.2.1 Comply with all laws, ordinances, rules, regulations, codes and orders of all authorities having jurisdiction relating to this work. Obtain and pay for all required permits and licences.

4.2.2 Comply with all rules of the Canadian Electrical Code, CSA Standard C22.1 and supplements, as amended for use in British Columbia.

4.2.3 Quality of work specified and/or shown on the drawings shall not be reduced by the foregoing requirements.

4.2.4 Give all required notices, submit drawings, obtain all permits, licenses and certificates and pay all fees required for this work.

4.2.5 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Engineer, prior to requesting final occupancy.

4.3 STANDARDS OF WORKMANSHIP

4.3.1 Execute all work in a competent manner and to present an acceptable appearance when completed.

4.3.2 Employ a competent supervisor and all necessary licensed tradesmen to complete the work in the required time.

4.3.3 Arrange and install products to fit properly into designated building spaces. Provide the Engineer with scaled layout drawings when requested.

4.3.4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

4.4 TESTS

4.4.1 The installation is to be free of opens and grounds. On completion, measure insulation resistance and comply with Table 24 of Canadian Electrical Code. Submit data sheet with values measured to the Engineer.

4.4.2 Test all wiring and connections for continuity and grounds before equipment is energized.

4.4.3 Before energizing system, check all connections, set and calibrate all relays and instruments for proper operation. Obtain necessary clearances, approval and instructions from supply authority.

4.4.4 Carry out all tests and furnish all equipment required to demonstrate safe and proper completion of the work, without additional cost to the Owner.

4.4.5 Check load balance on all feeders and make necessary adjustments to provide a “balanced” load.

4.4.6 NHA reserves the right to verify the contractors test results to determine if the system operation is satisfactory and contractor shall be responsible to correct any deficiencies for no additional cost.

4.5 PRODUCT DELIVERY SCHEDULE

4.5.1 Within fifteen days of award of contract, a schedule must be submitted by the Contractor to the Engineer showing projected ordering and delivery dates of all products to meet required construction schedule. Provide all necessary information regarding ordering and delivery dates for electrical products as required for scheduling.

4.6 SHOP DRAWINGS

4.6.1 After receiving approval of list of products and prior to ordering or manufacturing any products and sufficiently in advance of requirements to allow adequate time for checking, submit shop drawings to the Engineer for review. If shop drawings are not approved by the Engineer, make the required revisions and re-submit the drawings for review, before ordering or manufacturing the equipment. Refer to included shop drawing submittal form.

4.6.2 The Contractor shall thoroughly review all shop drawings to ensure they are complete and the product is suitable for the proposed use before submitting them. All shop drawings must be stamped and signed as approved by the Contractor before submission.

4.6.3 Show and carefully review details, dimensions, construction, size, arrangement, operating clearances, performance characteristics and capacities of products and parts of the work. Submit shop drawings in the same quantity and format described for approval of alternates in Part 2.1.6 of this Section.

4.6.4 The responsibility to provide a complete and operational system and to provide all the features and functions of the specified components shall remain with the Contractor, regardless of the information shown on the approved shop drawings.

4.6.5 Manufacture of products shall conform to approved shop drawings.

4.6.6 Keep one complete set of shop drawings at job site during construction.

4.6.7 Shop drawings for lighting fixtures must clearly show the ballast to be supplied.

4.6.8 The work of preparing and presenting the Product Delivery Schedule, Construction Schedule and list of products and shop drawings is to be included in the mobilization phase of the project.

Funds will not be advanced on the first progress payment until this information has been received.

4.7 AS-BUILT DRAWINGS

4.7.1 This Division shall maintain an up-to-date, clean, clearly marked-up set of “as-built” drawings on the job site which will be submitted to the Engineer for review when requested and which will be turned over to the Architect prior to Final Completion.

4.7.2 Where a note, fixture schedule or legend on the drawing identifies a product by manufacturer and part number, the as-built drawings shall show the manufacturer and part number of the product supplied.

4.7.3 As-built drawings must reflect final circuiting for all receptacles, lights and other equipment. Include all conduit and wiring routes, sizes and junction boxes. Provide dimensions and reference points for all conduits.

4.7.4 As-built drawings must show all telephone and data circuit designations, fire alarm device addresses and other communication circuits.

4.7.5 As-built drawings must show all information on equipment added or removed to the project by way of Addendum or Change Order and all equipment relocated from location shown on tender drawings.

4.7.6 As-built drawings must show all other project specific requirements as noted on the drawings.

4.7.7 As-built drawings and Operation and Maintenance Manuals must be neatly completed and submitted to the Engineer prior to Substantial Completion. **This project will not be considered substantially complete until all as-built information is received, including Operations and Maintenance Manuals.**

4.7.8 Should the Contractor fail to deliver the as-built information, or the information is not complete, the Engineer shall issue a written request for the required information.

4.7.9 Should the Contractor not provide the required information within seven days of written notice described above, the Engineer shall travel to site and obtain the information, including performing any required testing or other analysis required. The Engineer shall charge $150.00 per hour for all time spent obtaining the required information.

This cost, including travel time, travel costs, testing and other disbursements, shall be charged to the Contractor and withheld from the final payment.

4.8 TEST DATA

4.8.1 In addition to test data submitted in 4.4, submit test results of equipment and cables required by this Division to the Engineer as tests are completed.

4.9 MAINTENANCE MANUALS AND GUARANTEES

4.9.1 Prepare manuals covering the operating and maintenance of all electrical equipment installed under the contract.

4.9.2 Provide a draft copy to the Engineer for approval at least fifteen days before final inspection. Provide four final approved copies in suitably labelled, colour coded, tab indexed, 3-ring, loose-leaf, hard-cover binders and include one electronic copy in pdf format inside each binder.

4.9.3 The manuals shall contain the following information, organized for easy interpretation and reference by operating personnel:

4.9.3.1 A general description of each system stating the function of each item of equipment.
4.9.3.2 Copies of approved shop drawings and "as-built" drawings.
4.9.3.3 Manufacturer's maintenance brochures for each item, including wiring diagrams and parts lists. The specific model, the option or features and mode of control on the equipment installed shall be clearly indicated in each brochure. All data, except that pertaining to the model installed, shall be neatly "ruled" out.
4.9.3.4 Normal maintenance schedule and trouble shooting information for each major item.
4.9.3.5 Description of automatic control systems, instructions covering the operation and maintenance of the systems and schematic diagrams indicating the final control settings.
4.9.3.6 Letter from the Contractor stating that all labour and equipment installed under the Contract will be warrantied for one year from the date of substantial completion. Any piece of equipment or component that fails during this time will be repaired or replaced at no cost to the Owner.
4.9.3.7 Copies of all equipment manufacturer's guarantees that are in effect longer than the one year period described in item 4.9.3.6, above.
4.9.3.8 Include in the manual the Contractor's name, address and telephone number.

4.10 CUTTING AND PATCHING

4.10.1 Arrange for and pay all costs associated with all cutting and patching required as a result of work performed by this Division. When painting is required, the entire wall shall be painted to the nearest corner.

4.10.2 Repair any damaged surfaces to the condition of surrounding surfaces at no cost to

the Owner.

4.10.3 Where penetrations are made through new or existing fire walls or fire separations, ensure that approved materials are used as required to maintain the rated fire separation. Submit shop drawings to the Architect and obtain a ruling to ensure the proposed methods are satisfactory.

4.10.4 Where existing spray on fire stopping is removed or damaged by the Contractor, it shall be replaced or repaired by the Contractor to maintain fire rating.

4.11 REMOVED EQUIPMENT

4.11.1 All equipment removed and made surplus by the project shall be reviewed with the Owner to determine if they wish to retain it.

4.11.2 All equipment not identified as being retained by the Owner shall be disposed of by the Contractor. Contractor is responsible for all trash removal and disposal costs.

4.11.3 All equipment identified as being retained by the Owner shall be carefully removed and transported by the Contractor to a location on site determined by the Owner.

4.11.4 All fluorescent lamps removed shall be recycled by the Contractor. Provide documentation of recycling upon request.

4.11.5 Where ever possible, all equipment removed shall be sent for recycling or salvage. Any salvage value may be retained by the Contractor.

NRS ENGINEERING LTD
Consulting Electrical Engineers

SHOP DRAWING REVIEW

Copies	Date	Submittal No.	Description

Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, mounting systems, field construction criteria, materials, dimensions, catalog numbers and similar data and I have reviewed and approved this submittal and checked and coordinated each item with other applicable approved shop drawings and all contract requirements.

NOTES:

Signature: _____
Contractor

THE SUBMITTAL IS TRANSMITTED AS MARKED BY ENGINEER OF RECORD BELOW:

Approved	No notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.
Approved as Noted	Confirmation of the notations and comments IS NOT required by the Contractor. Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated in the final product.
Approved as Noted / Resubmit	Resubmittal to address all comments, omissions and non-conforming items that were noted.
Not Approved	Contractor must resubmit the entire package revised to bring the submittal into conformance.
Comments Attached	Comments are attached to the returned submittal which provide additional data to aid the Contractor.
Receipt Acknowledged	Not subject to the Engineer's review and approval; and, is being filed for informational purposed only.

This review is only for general conformance with the design concept and the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the Contract Documents nor from responsibility for errors or omissions in the shop drawings or samples. Approval of a specific item shall not include review of an assembly of which the item is a component. The Contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; quantities, material, catalog number, and similar data; information that pertains to the fabrication processes or the means, methods, techniques, sequences and procedures of construction; coordination of the Work with that of all other trades; performing all Work in a safe and satisfactory manner; and conformance with Contract Documents.

Signature: _____ **Date: _____**

Notes:

1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Provide a complete system of wiring making all connections necessary for the installation shown on the drawings.

1.1.2 Refer to Section 26 05 33 for conduit and cabling requirements. Support cabling in the same manner as outlined for conduit.

1.1.3 Wiring in plenum rated spaces shall be in EMT conduit with AC 90 drops to fixtures.

1.1.4 No horizontal runs of AC 90 cabling to be installed in interior partition walls. Vertical drops from junction boxes only.

1.1.5 Wiring that is exposed, subject to vandalism or mechanical damage shall be in conduit.

1.1.6 Wiring in hazardous areas must comply with Section 18 of the Canadian Electrical Code.

1.1.7 Make every effort to conceal wiring from public view. Confirm routing and location of visible conduits in any exposed ceiling area with Engineer prior to installation.

1.2 CODES

1.2.1 Install and rate power cables in accordance with the Canadian Electrical code requirements as amended for use in British Columbia and in accordance with the drawings. Where the drawing requirements exceed the minimum requirements of the Canadian Electrical Code, the drawing requirements shall take precedence. Do not use Ty-wraps for cable supports.

2 PRODUCTS

2.1 WIRE

2.1.1 X-Link: Copper conductors installed in conduit shall be sized as indicated with 600 volt insulation of chemically cross-link thermosetting polyethylene material, rated RW90, CSA C22.2 No. 38.

2.1.2 All building wire shall be AWG/MCM gauge, 98% conductivity copper with 600 volt insulation and shall bear CSA or other BC accredited testing and certification organization approval label except that CSA approved aluminum conductors may be used as feeders to panelboards, where they have ampacity equal to or greater than the specified feeder.

2.1.3 No wire smaller than #12 shall be used for lighting, receptacle, power or motor circuits. Control wiring to be #14 or #12 stranded or as specified on the drawing.

2.1.4 All branch circuit wiring installations shall be made with solid wire unless specified otherwise. All stranded wiring terminating at devices that do not have box type terminals shall be terminated using self insulating fork type compression terminals.

2.2 WIRE CONNECTORS

2.2.1 Solderless, self-insulated connectors for hand twist wire joints for lighting, small power, heating and associated control devices shall be Ideal “Supernut”.

2.2.2 Terminate conductors #8AWG and larger with Thomas & Betts colour-keyed compression connectors series 54000 or on lugs provided with equipment.

2.2.3 Thomas & Betts “KOPR-SHIELD” compound series CP8 on all terminations for compression connectors.

2.2.4 All wiring connections in underground junction boxes shall be made using silicone filled connectors or other waterproof Engineer approved method.

3 EXECUTION

3.1 CONDUCTORS

3.1.1 Before pulling wire, ensure conduit is dry and clean. If moisture is present thoroughly dry out conduits, vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease, soap, etc.. Employ suitable techniques to prevent damage to wire and insulation during pulling. Do not install wire when ambient temperature is below the minimum permitted for each insulation type.

3.1.2 Wiring to all line voltage light switch locations must contain a neutral conductor.

3.1.3 Provide sizes of conductors at minimum as shown on the drawings. Voltage drop from distribution panels to farthest outlet must not exceed 3% at full load in any case, re-size cabling to suit as required.

3.1.4 Branch circuit home runs exceeding 23M in length shall be minimum #10 gauge wire.

3.1.5 Wiring adjacent to any pipe, duct or piece of equipment giving off excess heat shall be done with wiring having an allowable conductor temperature of 110°C.

3.1.6 Each wire #8 and smaller entering a box shall be left with at least 175mm of wire clear of the box after splicing to facilitate future alterations.

3.1.7 Communication and signal circuits shall not be installed in the same conduit with power and lighting circuits, unless specifically accepted.

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

3.1.9 Provide a separate bonding conductor in all EMT conduit placed in concrete slab.

3.2 IDENTIFICATION, CODING & BALANCING

3.2.1 For branch circuit wiring, follow identification system shown on the drawings.

3.2.2 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on “as-built” drawings.

3.2.3 Colour code all feeders at all terminations, at all points where taps are made and at all panelboards, switchboards, motor control centres, etc., by means of colour insulation or markers. Use markers of a type not subject to aging or deterioration through heating, drying or easy erasure.

3.2.4 Colour code in accordance with Rule 4-036 of the Canadian Electrical Code.

3.2.5 For control wiring use #14 stranded with red insulation.

3.2.6 All control conductors are to be clearly labelled at both ends using commercially manufactured heat-shrink wire markers.

1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Provide a complete system of conduit and wire for all systems indicated.

1.1.2 All wiring is to be in conduit except where otherwise specifically noted.

1.1.3 Where not otherwise indicated, conduit shall be sized to the number and type of conductors used. Conduit fill shall not exceed the maximum conduit fill allowed under the Canadian Electrical Code, Rule 12-1014.

1.1.4 Provide a bonding conductor in all non-metallic conduit as required by the Canadian Electrical Code.

2 PRODUCTS & EXECUTION

2.1 GENERAL

2.1.1 Rigid conduit is to be used above ground and Rigid PVC conduit below ground, sized as indicated on the drawings. Exposed conduits are to be completely painted after installation to match surrounding surfaces.

2.1.2 Notwithstanding paragraph 2.1.1 indoor runs of conduit not subject to mechanical damage may be of EMT using **steel bodied** set-screw couplings and connectors. Connectors will have insulated throats.

2.1.3 Conceal raceways within attic spaces, crawl spaces and within walls. Surface raceways will be permitted in Electrical and Mechanical rooms only. Surface raceways in public areas shall only be acceptable when approved by the Engineer prior to installation. Surface raceways in public areas shall be Wiremold, with all connectors, boxes and hardware, colour to match surrounding surfaces at the discretion of the Engineer with no additional cost to the Owner.

2.1.4 Secure conduit with approved supports within one meter of every junction box, panel or fire alarm device and along the conduit run at intervals according to the Canadian Electrical Code, Rule 12-1010.

2.1.5 Surface runs of conduit will be neat in appearance, installed in straight runs following lines of the building and permitted only out of public view. Carefully review proposed conduit runs in exposed ceiling areas with the Engineer.

2.1.6 Conduits shall be capped at installation to prevent entry of foreign material and shall be cleaned by vacuum prior to installing conductors.

2.1.7 Male PVC adapters shall not enter into female metal hubs or couplings. When such need arises a steel conduit nipple will be threaded into the metal hub or coupling and then enter into a female PVC adapter.

2.1.8 All empty conduit systems will be left with a 4mm nylon pull cord installed, labelled to indicate points of origin.

2.1.9 All conduit, other than rigid steel conduit, placed in concrete slab must contain a separate bonding conductor.

2.1.10 Rigid PVC conduit shall be used for underground exterior work, except as directed by any utility for their work.

2.1.11 Galvanized rigid steel conduit shall be used for exposed exterior work.

2.1.12 For telephone and computer outlets, provide a conduit run to above the suspended ceiling.

2.1.13 Bends shall not be made over sharp objects. Improperly formed bends will not be accepted. All stub-ups from concrete into walls shall be adequately braced and capped before concrete is poured. Where stub-ups miss the partitions, the concrete shall be chiselled out and the conduit bent properly into place to come up within the wall, then the concrete surface shall be restored.

2.1.14 Conduits shall be laid out to avoid interference with other work and to avoid pockets in which water can collect.

2.1.15 Expansion joints shall be installed in all straight conduit runs exceeding 100 meters and all transitions from below to above grade conduit unless explicitly stated otherwise.

2.1.16 Bending of conduit shall be accomplished using equipment specifically designed and approved for the purpose. Improperly formed or flattened bends will be removed and replaced with properly executed bends.

2.1.17 Conduit within partitions will have a minimum size of 19mm.

2.1.18 The Engineer is to be advised a minimum of two days prior to backfilling of any conduit trench or pouring of any concrete slab and the trench is not to be backfilled or the slab poured until inspected and approved by the Engineer. Trenches backfilled or slabs poured without approval will be re-excavated, at the Contractor’s expense, to permit inspection of conduits or cables and sand bedding, marking and protection.

2.1.19 Final connections to motors, control devices, pressure switches and similar equipment shall be in flexible liquid-tight conduit, properly supported where required, with supports constructed from Canstrut or similar material.

2.1.20 All conduit is to be supported by CSA approved metallic two-hole conduit straps, by Canstrut and conduit clamps or by another Engineer approved method. Nylon tie-wraps shall not be used.

2.2 BOXES, CONDULET FITTINGS, ETC.

2.2.1 Where conduits are exposed, condulets with suitable covers shall be used wherever required. Each conduit fitting shall be of a type suitable to its particular use and of a type which will allow the installation of future conduits without blocking the covers of the existing condulets. Condulets with covers held on by screws which enter the wire chamber shall not be used.

2.2.2 Wherever necessary for the proper pulling or anchoring of cables, junction boxes or cable anchor boxes shall be installed. All boxes shall be installed so as to be accessible after the building is completed.

2.2.3 Where 2 or more switches, manual starters or other branch circuit devices are mounted adjacent to each other, they shall be installed in multi-gang boxes where practical.

2.2.4 In all empty conduit systems, in each run in excess of 30 meters long or where the equivalent of 3 x 90° bends exist, provide pullboxes at maximum 30 meter intervals. Pullboxes shall be aluminum 200 x 200 x 450 to remain accessible after construction is complete.

2.3 PULLBOXES AND JUNCTION BOXES

2.3.1 Provide all pullboxes as shown on the drawings, or as required for particular job conditions and specified by the Canadian Electrical Code.

2.3.2 Large junction boxes 8x8 or larger shall be equipped with CSA or other BC accredited testing and certification organization approved terminal strips, Weidmuller SAK 6 or approved alternate.

1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Provide a complete system of lamicoid labels, wire labels and other items to completely identify all electrical systems.

2 PRODUCTS & EXECUTION

2.1 LAMICOID LABELS

2.1.1 Lamicoid labels shall conform to the standards shown on the drawing, in this section. The wording shown on drawing is an example only, exact wording will depend on the item to be identified. Confirm wording with Engineer prior to manufacturing labels.

2.1.2 With reference to drawing in this section, place the following lamicoid labels on the equipment listed:

2.1.2.1 **TYPE A:** On all new distribution panelboards (centered above the door of the panel), splitters, transformers, fire alarm panels, lighting control panels and other control panels.

2.1.2.2 **TYPE B:** On all new fused disconnect switches (or disconnect switches containing circuit breakers) that feed distribution panelboards or other equipment.

2.1.2.3 **TYPE C:** On all new circuit breakers contained in the main distribution panel.

2.1.2.4 **TYPE D:** On all new starters, local disconnects, relay panels and junction boxes containing electrical equipment.

2.1.2.5 **TYPE E:** On the main distribution panelboard, centered above the main breaker. Obtain calculated fault level from the shop drawing submittals.

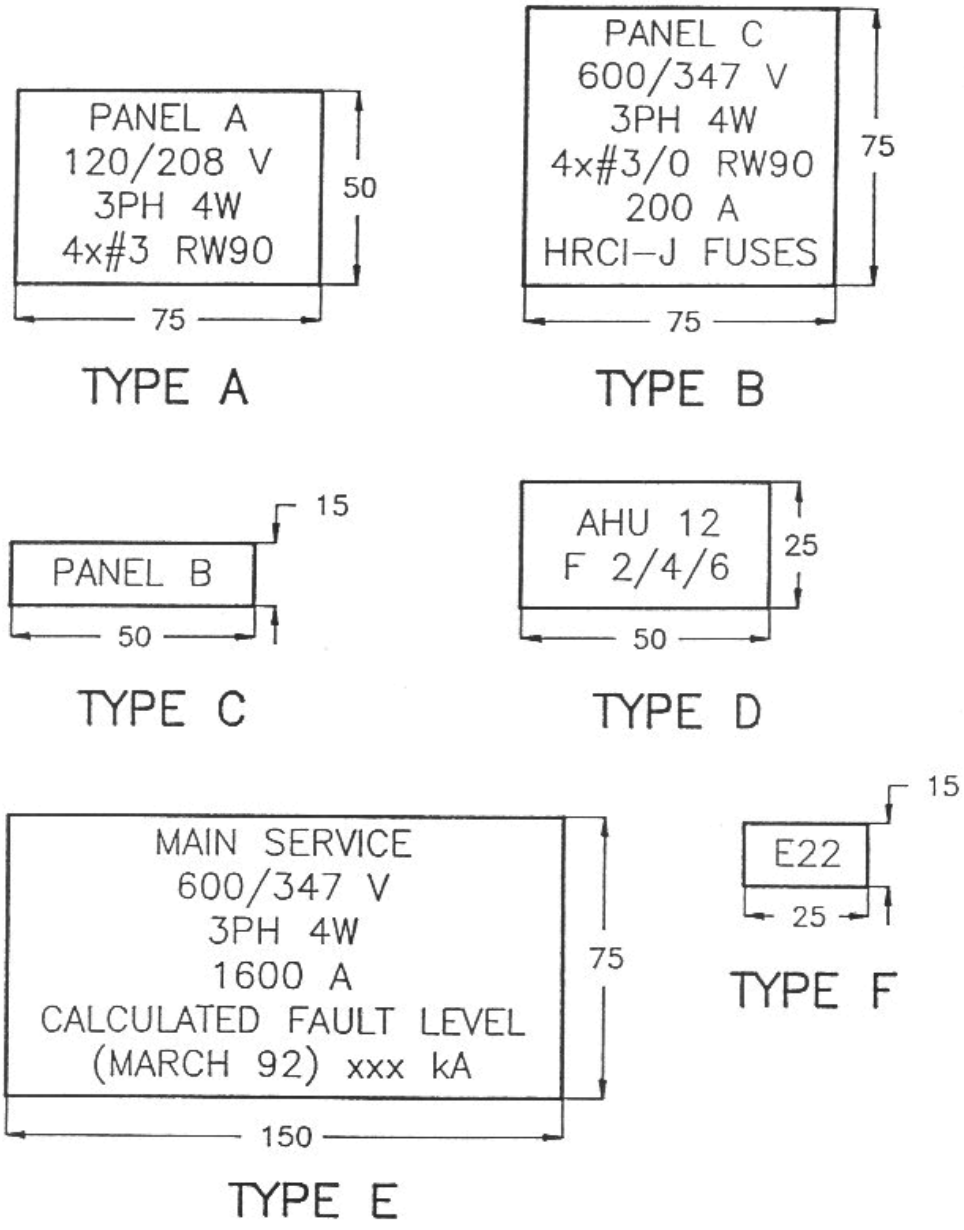
2.1.2.6 **TYPE F:** On the coverplate of all new receptacles, centered at the top of the coverplate and showing the panel and circuit number feeding that receptacle.

2.1.3 Use red lamicoids with white lettering for all essential power panelboards and other essential power equipment.

2.1.4 Labels for **receptacles** may be of a type similar to Brother P-Touch, clear labels with black lettering or red labels with black lettering for essential power circuits. All labels must be clean, neatly trimmed, installed horizontally and installed to the satisfaction of the Engineer. If not accepted by the Engineer, labelling shall be provided as described in Section 2.1.2.

2.2 WIRE LABELS

2.2.1 For all wire contained in control panels manufactured by this division, provide permanent, heat shrink, wire markers at both ends of each wire.



NOTES:

1. CONSTRUCT LABELS FROM 3 PLY LAMICOID, OUTER PLIES WHITE, CENTER PLY BLACK.

2. ALL TEXT TO BE 6mm HIGH, CENTERED ON LABEL.

3. EACH LABEL SHALL INCLUDE ADHESIVE BACKING.

1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Provide and install distribution panels and service switchgear to accommodate 120/208 V, 3-phase, 4-wire systems, as indicated on the drawings.

1.1.2 Provide new panelboards and circuits as indicated on the drawings, 66 circuit, 225 Amp unless otherwise noted. Panelboards must be rated to accept a full complement of tandem 15 Amp breakers with no derating.

1.1.3 Provide combination panel boards with integral main breaker where noted and where required by the Canadian Electrical Code.

1.1.4 Panels in public spaces to be flush mount white, with lockable door. Panels in service rooms can be ANSI 61 Grey.

2 PRODUCTS

2.1 PANELBOARDS

2.1.1 Eaton, or Square D series with bolt-on, breakers, kA to match study values.

2.1.2 Mounting arrangements as indicated on the drawings and on-site conditions.

2.1.3 Provide Type A lamicoid plates indicating panel designation and voltage. Mount at top center of panel face plate.

2.1.4 Flush mount panelboards must mount flush in wall shown and be white in colour.

2.1.5 All work required to fur out or trim a panelboard not meeting the requirements of 2.1.4, will be performed at no cost to the Owner. Such work must be approved by the Architect before and after completion.

2.1.6 All surface mount panelboards and switchgear to come with sprinkler hoods.

2.2 CIRCUIT BREAKERS

2.2.1 Provide breakers as required for supply of the identified loads.

2.2.2 Provide spare breakers as indicated on the drawings. Where not indicated, provide three 15A, single pole breakers in each panelboard.

2.3 FUSED DISCONNECT SWITCHES

2.3.1 Three pole, fused disconnect switches shall be as manufactured by Square D, type H36x or A8634x with size as indicated on the drawings, or approved equal from a pre-approved panelboard manufacturer.

3 EXECUTION

3.1 GENERAL

3.1.1 Maximum mounting height of panelboards shall be 2000mm to top. When panelboards are installed adjacent to one another, the top heights shall be aligned.

3.1.2 Circuit breakers shall be common trip only, no tie bars will be accepted.

3.1.3 Switchgear shall be arranged as indicated on the drawings.

3.1.4 Set adjustable trips on circuit breakers to protection values provided in the shop drawing submissions.

3.1.5 Provide painted plywood backing where required for mounting electrical equipment, do not mount electrical equipment directly to exterior building walls. Plywood to be painted before installation of any equipment.

3.1.6 Provide revised, typewritten panel directories for all panelboards utilized on this project.

3.1.7 From each panelboard, flush mounted in wall, extend two 38mm empty conduits into ceiling space for future use.

3.1.8 All secondary breakers, panelboards, etc., shall be thoroughly tested before energizing the electrical system. The tests shall be performed in the presence of the Engineer. The result of the tests shall be to his satisfaction and shall conform to the requirements of the Canadian Electrical Code and the Electrical Inspection Department. Tests shall be performed with a meggar. Test reports shall be included in “Electrical Data for Maintenance Personnel”.

1 GENERAL

1.1 SCOPE OF WORK

1.1.1 Provide all wiring devices shown on drawings and/or detailed in this specification.

2 PRODUCTS

2.1 QUALITY

2.1.1 All wiring devices are to be “Specification Grade” unless specified otherwise.

2.2 SPECIAL CODE REFERENCES

2.2.1 Manually operated general purpose switches: to CSA C22.2 No. 111.

2.2.2 Receptacles, plugs and similar wiring devices: to CSA C22.2 No. 42.

2.2.3 Other devices to applicable current CSA standard.

2.3 MANUFACTURER

2.3.1 Wiring devices to be of one manufacturer throughout the project.

2.3.2 Approved manufacturers of wiring devices are: Arrow-Hart, Bryant, Cooper, Hubbell, Leviton, Pass & Seymour and Smith & Stone, provided that device is equal in every respect to the unit specified.

2.4 SWITCHES

2.4.1 Switches are to be 125V, 15A:

2.4.1.1 White thermoplastic toggle,
2.4.1.2 Side wired,
2.4.1.3 Single pole - specification grade, Hubbell 1201-W,
2.4.1.4 Three-way - specification grade, Hubbell 1203-W.

2.5 RECEPTACLES

2.5.1 Duplex receptacles, CSA Type 5-15 R 125V, 15A, U-ground, with the following features:

2.5.1.1 White impact resistant nylon face,
2.5.1.2 Suitable for No. 10 AWG side wiring,
2.5.1.3 Break-off links for use as split receptacle,
2.5.1.4 Four side wiring screws,
2.5.1.5 Triple wipe power contacts and rivetted grounding contacts,
2.5.1.6 Specification grade, Hubbell CRF15-CN,
2.5.1.7 Ground Fault, Hubbell GF5252-CN.

2.5.2 Isolated ground duplex receptacles, CSA Type 5-15 R 125V, 15A, U-ground.

2.5.2.1 Orange impact resistant nylon face,
2.5.2.2 Suitable for No. 10 AWG side wiring,
2.5.2.3 Break-off links for use as split receptacle,
2.5.2.4 Four side wiring screws,
2.5.2.5 Triple wipe power contacts and rivetted grounding contacts,
2.5.2.6 Specification grade, Hubbell IG5252-CN.

2.6 BACKBOXES AND COVER PLATES

2.6.1 Backboxes are to be:

2.6.1.1 Type MBS for masonry construction.
2.6.1.2 Type 3104 for steel stud construction.
2.6.1.3 Type 1110 for surface mounting.

2.6.2 Provide brushed stainless steel cover plates for all wiring devices.

2.6.3 Use sheet steel utility box cover for wiring devices installed in surface mounted utility boxes.

2.6.4 Use flush mount cover plates for all wiring devices mounted in flush-mounted outlet boxes.

2.6.5 All outlet boxes installed on steel stud walls shall have an outlet box support (Commander-Iberville #820-D) installed on the non-stud side of the box.

2.6.6 Provide outlet boxes with integral vapour barriers for all outlet boxes on exterior walls or insulated ceilings.

3 EXECUTION

3.1 GENERAL

3.1.1 All devices must be provided with wiring terminal screws and wiring is to be securely wrapped around the screw and the screw tightened. Use of “push-in” or “push-on” terminators is not acceptable.

3.2 INSTALLATION

3.2.1 Switches:

3.2.1.1 Install single throw switches with handle in the “UP” position when switch closed, rocker switches “UP” for “ON”.
3.2.1.2 Install switches vertically in outlet box. When more than one switch is required in one location, gang type boxes should be used.

3.2.2 Receptacles:

3.2.2.1 Install receptacles vertically in outlet box with plaster ring. When more than one receptacle is required in one location, gang type boxes may be used.

3.2.3 Cover Plates:

3.2.3.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
3.2.3.2 Install suitable common cover plates where wiring devices are grouped.
3.2.3.3 Do not use cover plates meant for flush outlet boxes on surface mounted boxes.

3.3 MOUNTING HEIGHT

3.3.1 Wherever possible mount equipment in a straight line at a uniform mounting height in co-ordination with other equipment and materials.

3.3.2 Use the following as a guide line to the requirements:

3.3.2.1 Receptacles: 450mm above floor or as shown on the drawings.
3.3.2.2 Switches: 1150mm above floor to bottom of device.
3.3.2.3 Where devices are grouped together or positioned close together; they are to be aligned at the same height.

3.4 VERIFICATION

3.4.1 Verify all receptacles have been wired correctly using a Hubbell #5200 outlet circuit tester. Provide written test results to the Engineer.