1. GENERAL SPECIFICATIONS

1.1. GENERAL

1.1.1. The Contractor shall supply all labour, material, equipment, transportation, services and facilities necessary to make, test and place into operation a complete electrical installation as shown on the drawings and/or as specified herein.

1.1.2. Where the term "provide" is used herein, it shall mean "supply, install, adjust, test and place into operation", unless specifically noted otherwise.

1.1.3. The Contractor shall carefully examine the drawings, specifications and existing site conditions and shall include in their tender all items implied or required to complete the work of this contract.

1.1.4. The Contractor shall comply with all site safety requirements as directed by the owner or owner's designate.

1.1.5. All hot work shall be coordinated with the owner or owner's designate.

1.1.6. The electrical drawings do not show all architectural, mechanical and structural details. All electrical schematics are shown diagrammatically unless otherwise noted. The Contractor shall review the entire drawing set to obtain building dimensions and details. Verify dimensions accurately by measurements.

1.1.7. Contractor to obtain and pay for all permits and inspections required by the local inspection authority having jurisdiction.

1.2. EXTENT OF WORK

1.2.1. This work shall consist of furnishing of all labour, material, equipment and all incidentals required for by the project for a complete electrical and/or control system as defined in the drawings and specifications including but not limited to the following:

1.2.1.1. Disconnection and removal of power for equipment affected by roof replacement.

1.2.1.2. Relocation of conduits and cables affected by roof replacement.

1.2.1.3. Reconnection of replaced equipment as required by roof replacement.

1.3. APPROVED DESIGN AND INSTALLATION

1.3.1. Equipment and material to be of approved design and manufactured in accordance with all governing regulations such as "Canadian Standards Association", "Canadian Electrical Code", "Provincial Department of Labour", "Underwriters Laboratory", etc. Equipment and material must bear applicable acceptance labels of all associations and governing bodies recognized by the municipal, provincial and federal authorities.

1.3.2. All installation to be in accordance with the current adopted codes in the area of installation including all local amendments and bylaws:

1.3.2.1. National Building Code of Canada

1.3.2.2. National Fire Code of Canada

1.3.2.3. Manitoba Electrical Code

1.3.2.4. Install equipment in strict accordance with manufacturer's recommendations and governing rules, regulations and codes.

1.3.2.5. Material installed to be new and of uniform construction.

1.3.2.6. All installations are to ensure maximum headroom, minimum interference with free use of surrounding areas, and best access to equipment.

1.4. CODES AND STANDARDS

1.4.1. Install all equipment in accordance with current editions of the Electrical Code, including all local amendments unless otherwise specified.

1.4.2. Perform all work in accordance with drawings, specifications, applicable municipal and provincial regulations, and any pertinent inspection bulletins issued by the electrical inspection authority having jurisdiction over the installation. The most stringent requirements shall apply.

1.5. COOPERATION AND COORDINATION

1.5.1. Contractor responsible for coordination of work/installation with other trades to ensure installation schedule and physical installation of components do not interfere with each other.

1.6. GUARANTEE

1.6.1. Guarantee work described in this Section of the specification against all defects in labour and materials.

1.7. APPROVAL OF ALTERNATE MATERIALS

1.7.1. Tenders shall be based on the materials, products, and manufacturers specified.

1.7.2. Requests for alternates to materials, products, and manufacturers specified shall be sent to Engineer prior to installation. Only approved products or materials are to be used.

1.8. INSTALLATION

1.8.1. Determine manufacturers' recommendations regarding storage and installation of equipment and adhere to these recommendations.

1.8.2. Check all factory joints and tighten where necessary to ensure continuity.

1.8.3. Keep power feed cables separated from any control, instrumentation, or communication cables by sufficient distance to prevent electrical interference by the power feeds onto any of the control, instrumentation, or communications cables. Where these types of cables must cross, the crossings shall be perpendicular to each other.

1.9. FIREPROOFING

1.9.1. Where sleeves or openings are installed in walls, floors, roof or partitions to accommodate raceways, cables or bus duct, provide all necessary seals, fittings, barriers and fire resistant materials to restore the installation to its original fire rating to the satisfaction of the Engineer and the Owner's insurance underwriters.

1.9.2. Utilize Firestop Pillows or Firestop Bricks for cable tray systems.

1.10. EQUIPMENT IDENTIFICATION

1.10.1. Supply and install identification lamacoid nameplates on all equipment such as motor starters, safety switches, panelboards, pushbutton stations, etc. All nameplates shall be securely fastened to equipment with stainless steel screws, or hung with stainless steel chains.

1.10.2. Warning nameplates required by Inspection Authorities shall be provided for all electrical switchgear and equipment and on access doors to electrical rooms, vaults, switchyards, etc. in accordance with the applicable Code regulations. Obtain all necessary details from the Inspection Authorities.

1.10.3. Identify pull boxes, terminal cabinets and junction boxes enclosing cables or connections with nameplates indicating voltage, box number and circuit number.

1.11. HANGERS AND SUPPORTS

Provide hangers, angles, channels, and other supports necessitated by field conditions to install all items of electrical equipment.

1.12. TESTING OF ELECTRICAL SYSTEMS

1.12.1. Prior to Engineer's acceptance, all electrical equipment, materials and systems installed shall be subject to an inspection and applicable performance tests. Engineer reserves the right to witness such testing. Coordinate testing with Engineer.

1.12.2. Ensure that the system and its components are ready prior to the inspection and test for acceptance.

1.12.3. All testing shall be conducted by fully qualified personnel only.

1.12.4. Supply all instruments, meters and personnel required for the tests.

1.12.5. Power Cables 1000V and Below:

1.12.5.1. Tests on cables in this voltage range shall be limited to insulation resistance measurements using a 500V megger for systems up to 350V and a 1000V megger for 351-600V systems.

1.12.5.2. All testing to be completed prior to connection of equipment, with cable ends suitably isolated to prevent accidental contact with equipment. Under no circumstances shall testing be completed with wires/cables connected.

1.12.5.3. Record all test results in a log book and submit to the Engineer for reference. Replace or repair all circuits, which do not meet minimum requirements specified in the Electrical Code, Table 24.

1.12.5.4. Insulation resistance of the following circuits shall be measured:

1.12.5.4.1. Power Feeders to Electrical Equipment

1.12.5.4.2. Power Feeders to Mechanical Equipment

2. WIRE AND CABLE

2.1. LOW VOLTAGE WIRE 1000 VOLT AND BELOW

2.1.1. All wire and cable shall have CSA, cUL, or ETL certification.

2.1.2. All wire shall have stranded, annealed copper, cross linked polyethylene (XLPE) insulation, - 40°C rated, 90°C maximum conductor temperature, limited flame spread. Aluminum conductors not permitted.

2.1.3. Except where otherwise stated, the minimum conductor insulation rating shall be equal to or greater than the highest voltage to which the insulation may be exposed, but in no case less than 300V.

2.1.4. The wiring shall be suitable for installation in the area in which it is installed.

2.1.5. Minimum power conductor size shall be #12 AWG unless otherwise specified. #14 AWG copper may be used for control power wiring, unless otherwise specified.

2.1.6. Minimum Field Instrumentation wire size shall be #16AWG. Analog signal wires shall be twisted shielded pair or twisted shielded triad as required.

2.1.7. Colour coding of insulated conductors shall conform to Electrical Code.

2.1.8. Insulated ground conductors forming part of a multi conductor cable assembly shall have green colour coding.

2.1.9. Approved cable and wire manufacturers are: Nexans Canada, Phillips Cables Ltd., Prysmian FP, GeneralCable Inc. and Southwire

2.2. TECK CABLE

2.2.1. Conductors

2.2.1.3. All conductors to be copper.

2.2.1.4. Insulation: Chemically cross-linked thermosetting polyethylene rated 600-volt, RW90 for normal and wet locations

2.2.1.5. Inner Jacket: polyvinyl chloride material (Teck cable)

2.2.1.6. Armor: interlocking aluminum

2.2.1.7. Overall covering: PVC material, colour black, flame retardant, FT4 rated, AG14.

2.2.1.8. Fastenings:

2.2.1.8.1. One-hole straps to secure surface cables 50 mm and smaller. Two-hole straps for cables larger than 50 mm. All straps to have inert spacers between strap and concrete.

2.2.1.8.2. Channel type supports for two or more cables.

2.2.1.8.3. Minimum 3/8" (6mm) diameter threaded rods, or larger per manufacturer's guidelines to support the load carried upon suspended channels.

2.2.1.8.4. All fastenings and supports must:

2.2.1.8.4.1. Suit the environment in which they are installed, per Electrical Code

2.2.1.8.4.2. Be compatible with the strut, channel, and/or cable tray with which they are in contact per the manufacturer's instructions

2.3. VFD POWER CABLES

2.3.1. 1kV rated cable to CSA C22.2 No 123-16 and CSA C22.2 No 174-M1984, latest editions, designed to reduce high frequency noise interference with data and control signals.

2.3.2. Three bonding conductors – soft bare copper.

2.3.3. Cross-linked polyethylene RW90 insulation on main conductors.

2.3.4. Continuously corrugated, corrosion resistant aluminum sheath with matching connectors.

2.3.5. Overall PVC jacket rated CSA FT4.

2.3.6. Acceptable manufacturer shall be Nexans DriveRx VFD Cable, General Cable CCW Type 9675, Belden 12295xx or approved equal.

2.4. ETHERNET CABLING

2.4.1. All Ethernet cabling shall be CAT 6, round, unshielded, unless otherwise specified. Where field-installed terminations must be used, they shall use CAT 6 connectors with load bars (separately installed, or integral to the connector).

2.4.2. Conductors may be 24 or 26 AWG. Selected AWG shall be used throughout the project for fixed runs between equipment locations.

2.4.3. Cables for fixed runs between equipment locations shall use solid conductors.

2.4.4. Patch cables, under 10m, between equipment in a given panel, MCC, or from wall outlets to PCs shall use stranded conductors for flexibility.

2.4.5. The tightest bend radius of the cable during and after installation shall be no less than 5 times the cable diameter.

2.4.6. Any Ethernet cable that runs in air circulation spaces (ducts, suspended ceilings, etc.), and is not enclosed in conduit, shall be plenum rated.

2.4.7. 4P8C connectors shall be CSA, cUL, or ETL certified. They shall match the cable type (unshielded or shielded).

2.4.8. The crimping tool and associated dies shall be selected to match the 4P8C connectors to avoid connector damage during crimping.

2.4.9. Field-terminated 4P8C end connectors shall be selected so that the contact type matches the conductor type. Solid conductors require contacts for solid conductors, and stranded conductors require contacts for stranded conductors; the two types are not interchangeable. A universal style may be used but shall be explicitly made for universal application.

2.4.10. Factory pre-made and field-terminated cables both shall use the 568A termination pattern:

T568A Color	Pin
white/green stripe	1
green solid	2
white/orange stripe	3
blue solid	4
white/blue stripe	5
orange solid	6
white/brown stripe	7
brown solid	8

2.4.11. Field Ethernet cables in process areas shall be Belden 121872A or approved equal.

2.5. WIRING ACCESSORIES

2.5.1. Wire markers, black letters on white background, shall be heat shrink type as manufactured by Critchley or Brady.

2.5.2. Cable markers for cables or conductors greater than 13 mm (1/2 inch) diameter, shall be strap on type, rigid PVC, black letters on white background.

2.5.3. Terminal blocks shall be minimum 600-volt rated, modular, sized to accommodate conductor size used, as manufactured by Weidmuller or Phoenix

2.5.4. Cable ties shall be nylon, one piece, self locking type, as manufactured by Thomas & Betts, Burndy, or Electrovert.

2.5.5. Electrical insulating tape as manufactured by 3M Scotch 88.

2.5.6. Cable grips shall be provided for all vertical and catenary cable suspension installations to reduce cable tension at connectors or at cable bends. The cable grips shall be selected to accommodate the type and geometry of cable supported and shall be of the single weave, variable mesh design, as manufactured by Kellems, Arrow-Hart.

2.5.7. Cable pulling lubricant shall be compatible with cable covering and shall not cause damage and corrosion to conduits or ducts.

2.6. INSTALLATION

2.6.1. Install wire into cable trays or conduits in accordance with the manufacturer's recommendations, using patented wire grips suitable for the type of wire or using pulling eyes to be installed directly onto the conductors.

2.6.2. Limit pulling tensions to those recommended by the manufacturer to avoid overstressing wire.

2.6.3. Make connections to equipment "pig tails" with mechanical, insulated, screw on connectors for wire sizes #14-# 10 AWG. For wire sizes #8 AWG and larger utilize split bolt connectors, taped with three layers minimum of insulating tape. For both copper and aluminium terminations, wire through the conductor, apply joint compound anti-oxidant, and torque to lug manufacturer's recommended torque levels.

2.6.4. No splices shall be permitted in cable or wiring runs without the written permission of the Engineer, and shall only be permitted in junction boxes.

2.6.5. Neutral conductors shall be identified. Paint or other means of colouring the insulation shall not be used.

2.6.6. Unless otherwise specified, make all wiring taps, splices and terminations with identified compression tension clamp terminal blocks, securely fastened to avoid loosening under vibration or normal strain

2.6.7. Identify each conductor by specified markers at each termination indicating the circuit designation or wire number.

2.6.8. Separate power and signal cables in cable tray to opposite sides of tray - utilize aluminum tray divider to segregate sections.

SCRATCH architecture inc.

ENGINEERS GEOSCIENTISTS MANITOBA
CERTIFICATE OF AUTHORIZATION
APOLLO ENGINEERING LTD.
CERTIFICATE NO. 6577

APOLLO ENGINEERING LTD
Electrical & Automation Consulting

Issued for Construction - 07.17.2020

PROVINCE OF MANITOBA
B.S. JANZ
MEMBER 20894
REGISTERED PROFESSIONAL ENGINEER
2020-07-24

PROJECT: City Hall Administration Building Roof Replacement
510 Main Street

CLIENT: City of Winnipeg

APPROVED BY: B. Janz

DATE: July 2020

BID OPPORTUNITY: 430-2020

PROJECT NO.: 19-0701

DWG NO.: E300