

ELECTRICAL SPECIFICATIONS

1 REFERENCE STANDARDS

- 1.1 ANSI - AMERICAN NATIONAL STANDARDS INSTITUTE
ASTM - AMERICAN NATIONAL STANDARD TESTING AND MATERIALS
EEMAC - ELECTRICAL EQUIPMENT MANUFACTURER'S ASSOCIATION OF CANADA
IEEE - INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
IPCEA - INSULATED POWER CABLE ENGINEERS ASSOCIATION
NEMA - NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION
- 1.2 MATERIAL SHALL CARRY CSA APPROVAL AND CONFORM TO EEMAC STANDARDS.
- 1.3 EQUIPMENT WIRING AND WIRING DEVICES SHALL MEET THE REQUIREMENTS OF THE CURRENT EDITION OF THE CANADIAN ELECTRICAL CODE AND APPLICABLE ELECTRICAL SAFETY BULLETINS, CSA ELECTRICAL BULLETINS, CANADIAN BUILDING CODE, AND LOCAL BY-LAWS.

2 GENERAL REQUIREMENTS

- 2.1 BIDDERS IN PREPARING THEIR TENDER, FINDING ANY ERRORS, OMISSION, OR DISCREPANCIES IN THE DRAWINGS, SPECIFICATIONS OR OTHER DOCUMENTS, OR HAVING ANY DOUBT IN THE INTENT OR MEANING OF ANY PART THEREOF, SHALL IMMEDIATELY NOTIFY THE ENGINEER, WHO WILL SEND WRITTEN INSTRUCTIONS OR CLARIFICATION TO ALL BIDDERS. WHERE SUCH DISCREPANCIES EXIST AND IT IS EVIDENT THAT THIS CONTRACTOR COULD NOT HAVE PROPERLY TENDERED WITHOUT CLARIFICATIONS AND WHERE SUCH CLARIFICATION WAS NOT REQUESTED, NOT EXTRA TO THE CONTRACT WILL BE CONSIDERED IN ORDER TO HAVE THE INSTALLATION PROPERLY MADE. THE OWNER AND ENGINEER WILL NOT BE RESPONSIBLE FOR ORAL INSTRUCTION.

- 2.2 THE ELECTRICAL DRAWINGS AND THESE SPECIFICATIONS ARE COMPLEMENTARY TO EACH OTHER, SHOULD ANY DISCREPANCIES OCCUR, THE MORE RESTRICTIVE CONDITIONS WILL APPLY, UNLESS OTHERWISE INSTRUCTED BY THE ENGINEER.

- 2.3 THE ELECTRICAL CONTRACTOR SHALL SUPPLY ALL LABOUR, MATERIALS, TOOLS, EQUIPMENT, TRANSPORTATION REQUIRED FOR THE COMPLETE INSTALLATION, WIRING AND TESTING OF THE SYSTEMS SHOWN ON THE DRAWINGS AND DESCRIBED HEREIN.

- 2.4 CO-OPERATE WITH OTHER SECTIONS AS REQUIRED FOR THE COMPLETION OF THE WORK.

- 2.5 THE ELECTRICAL DRAWINGS INDICATE THE GENERAL LOCATION AND ROUTE TO BE FOLLOWED BY CONDUITS AND/OR WIRE AND DO NOT SHOW ALL ARCHITECTURAL, STRUCTURAL, AND MECHANICAL DETAILS. ALL NECESSARY COMPONENTS SHALL BE INSTALLED TO PROVIDE A COMPLETE OPERATING SYSTEM EVEN THOUGH SOME INDIVIDUAL COMPONENTS MAY NOT BE SHOWN IN THE PLANS. ANY COMPONENT OR SERVICE NOT DESCRIBED, BUT REASONABLY OBVIOUS AS REQUIRED FOR COMPLETION SHALL BE INCLUDED BY THE CONTRACTOR AT NO COST.

- 2.6 THE ELECTRICAL TRADE IS EXPECTED TO FOLLOW THE ARCHITECTURAL, STRUCTURAL AND MECHANICAL DRAWINGS FOR DETAILS OF THIS WORK AND SHALL INSTALL ELECTRICAL CONDUIT, BOXES AND FITTINGS TO CO-ORDINATE WITH ARCHITECTURAL, STRUCTURAL AND MECHANICAL WORK AND DETAILS.

- 2.7 MATERIALS ARE TO BE NEW, EQUAL OR SUPERIOR TO THE QUALITY SPECIFIED, AND CONFORM TO CSA STANDARDS.

- 2.8 EXECUTE WORK IN A NEAT AND ORDERLY MANNER TO THE SATISFACTION OF THE ENGINEER.

- 2.9 TRADESMEN THOROUGHLY QUALIFIED AND EXPERIENCED MUST BE EMPLOYED TO CARRY OUT SPECIALIZED WORK SUCH AS: MOTOR CONTROLS, AUDIBLE AND VISUAL SIGNALING SYSTEMS, AND INTERCOMMUNICATION SYSTEMS.

- 2.10 NO DEVIATION FROM THE DRAWINGS SHALL BE PERMITTED WITHOUT WRITTEN AUTHORIZATION FROM THE ENGINEER.

- 2.11 ALL WORK AND MATERIALS COVERED BY THESE SPECIFICATIONS SHALL BE SUBJECT TO INSPECTION AT ANY AND ALL TIMES BY THE ENGINEER OR THE OWNER'S REPRESENTATIVE.

- 2.12 MAINTAIN UNIFORMITY OF MANUFACTURE, TYPE AND STYLE, WITHIN A PARTICULAR GROUP OR CLASS OF EQUIPMENT THROUGHOUT THE WORK.

- 2.13 THE "UTILITY" SHALL HEREAFTER MEAN THE ELECTRICAL POWER SUPPLY.

- 2.14 EXAMINE CONTRACT DOCUMENTS FOR CEILING SPACE. EXAMINE STRUCTURAL, ARCHITECTURAL AND MECHANICAL OBSTRUCTIONS. EXAMINE MANUFACTURER'S REQUIREMENTS FOR MAINTENANCE.

- 2.15 EXAMINE SHOP DRAWINGS OF EQUIPMENT OF OTHER TRADES.

3 SHOP DRAWINGS

- 3.1 SUBMIT SHOP DRAWINGS FOR AT LEAST THE FOLLOWING ITEMS:

- 3.1.1 ALL DISTRIBUTION PANELS, SUB-DISTRIBUTION PANELS, PANELBOARDS, DISCONNECT SWITCHES, CIRCUIT BREAKERS AND FUSE DETAILS AND TRIPPING CHARACTERISTICS, INSTRUMENT TRANSFORMERS AND PROTECTIVE RELAYS, ETC.

- 3.1.2 MOTOR CONTROL EQUIPMENT INCLUDING STARTERS, CONTACTORS, OVERLOAD HEATER DATA, CONTROL RELAYS, TIME DELAY RELAYS, MOTOR CIRCUIT AND CONTROL CIRCUIT FUSES/BREAKERS AS APPLICABLE, PILOT LIGHTS, CONTROL TRANSFORMERS, AND SELECTOR SWITCHES, ETC.

- 3.1.3 ALL LUMINAIRES INCLUDING EMERGENCY LIGHTING EQUIPMENT, BALLAST, LAMP AND LENS INFORMATION.

- 3.1.4 ALL ELECTRICAL HEATING EQUIPMENT AND THERMOSTATS.

- 3.1.5 ALL FIRE ALARM COMPONENTS.

- 4 PERMITS, CERTIFICATES, AND FEES

- 4.1 PRIOR TO COMMENCEMENT OF WORK, SUBMIT THE NECESSARY DRAWINGS TO THE ELECTRICAL INSPECTION AUTHORITY.

- 4.2 PAY ALL ASSOCIATED FEES, AND PERMITS ASSOCIATED WITH THE ELECTRICAL WORK.

- 4.3 ON COMPLETION OF THE WORK SUBMIT A CERTIFICATE OF ACCEPTANCE FROM INSPECTION AUTHORITY TO THE ENGINEER.

5 INSPECTION OF WORK/TESTS

- 5.1 BEFORE ENERGIZING ANY PORTION OF THE ELECTRICAL SYSTEM, PERFORM MEGGER TESTS ON ALL FEEDERS AND BRANCH CIRCUITS. RESULTS SHALL CONFORM TO CANADIAN ELECTRICAL CODE, TO THE SATISFACTION OF THE AUTHORIZED INSPECTION AUTHORITY AND THE ENGINEER.

- 5.2 PERFORM VOLTAGE CHECK THROUGHOUT THE BUILDING AND IF DIRECTED BY THE ENGINEER, ADJUST CIRCUITING.

- 5.3 IN COOPERATION WITH THE MECHANICAL SECTION, TAKE CLAMP ON AMMETER READINGS ON ALL PHASES OF ALL MECHANICAL EQUIPMENT MOTORS WITH MOTORS OPERATING UNDER FULL LOAD CONDITIONS. TEST READINGS SHALL BE SUBMITTED TO THE ENGINEER AND MUST BE INCLUDED IN THE MAINTENANCE MANUALS.

6 START UP

- 6.1 INSTRUCT PERSONNEL IN OPERATION, CARE AND MAINTENANCE OF INSTALLATION, AT A TIME ARRANGED WITH THE ENGINEER/OWNER'S REPRESENTATIVE.

7 SCOPE OF WORK

- 7.1 THE WORK IN THIS DIVISION INCLUDES, BUT IS NOT NECESSARILY LIMITED TO THE FOLLOWING:

- 7.1.1 SERVICE CONDUITS AND CONDUCTORS.

- 7.1.2 UTILITY COMPANY FEES.

- 7.1.3 SUPPLY AND INSTALLATION OF MAIN DISTRIBUTION AND SUB-DISTRIBUTION EQUIPMENT, AND BRANCH CIRCUIT PANELS.

- 7.1.4 SUPPLY AND INSTALLATION OF A SYSTEM OF FEEDERS IN CONDUIT FOR POWER PANELBOARDS AND BRANCH CIRCUIT PANELBOARDS.

- 7.1.5 SUPPLY AND INSTALLATION OF BRANCH CIRCUIT WIRING FOR LIGHTING, RECEPTACLES, ETC.

- 7.1.6 SUPPLY AND INSTALLATION ALL CONTROLS AND WIRING FOR MECHANICAL EQUIPMENT.

- 7.1.7 SUPPLY AND INSTALLATION OF ELECTRICAL HEATING EQUIPMENT. SEE SCHEDULE, SPECIFICATION, AND NOTES ON MECHANICAL DRAWINGS.

- 7.1.8 SUPPLY AND INSTALLATION OF WALL SWITCHES, RELAYS, AND RECEPTACLES.

- 7.1.9 SUPPLY AND INSTALLATION OF TELEPHONE DISTRIBUTION PANELS, CONDUITS, RACEWAYS, PULL BOXES, OUTLETS, AND ALL CABLING TO MAKE A COMPLETE AND OPERATIONAL SYSTEM.

- 7.1.10 SUPPLY AND INSTALLATION OF CABLE TV PATCH PANEL, CONDUITS, RACEWAYS, PULL BOXES, OUTLETS AND ALL CABLING TO MAKE A COMPLETE AND OPERATIONAL SYSTEM.

- 7.1.11 SUPPLY AND INSTALLATION OF ALL HANGERS, ANCHORS, SLEEVES, CHASES, SUPPORTS FOR FIXTURES, ALL ELECTRICAL MATERIAL, AND EQUIPMENT.

- 7.1.12 SUPERVISING OF EXCAVATION OR TRENCHING IN CONNECTION WITH ELECTRICAL WORK. USE ONLY BACKFILL FOR TRENCHES WHICH IS FREE FROM ROCKS, LARGE ROOTS, OTHER VEGETATION OR ORGANIC MATTER, AND FROZEN MATERIAL.

- 7.1.13 SUPPLY AND INSTALLATION OF CONDUIT, WIRES, AND ASSOCIATED DEVICES REQUIRED FOR CONTROLS RATED 120V CONTROL. CONDUIT RUNS AND WIRING MAY OR MAY NOT BE SHOWN ON THE ELECTRICAL DRAWINGS. IT IS NEVERTHESS IMPLIED THAT THIS CONTRACTOR MUST INSTALL ALL CONDUITS, WIRING, AND DO ALL WIRING REQUIRED FOR THE PROPER SYSTEM OPERATION AS LONG AS THE CONTROL REQUIREMENTS ARE SPECIFIED UNDER OTHER DIVISIONS.

- 7.1.14 SUPPLY AND INSTALLATION OF CONDUIT, WIRES, AND ASSOCIATED DEVICES FOR ALL MECHANICAL EQUIPMENT INTERLOCKING AT LINE AND LOW VOLTAGE.

- 7.1.15 SUPPLY AND INSTALLATION OF ALL MAGNETIC STARTERS, MANUAL STARTERS, VARIABLE FREQUENCY DRIVES, AND ANCILLARY DEVICES.

- 7.1.16 SUPPLY AND INSTALLATION OF ALL LIGHTING FIXTURES.

8 MOUNTING

- 8.1 UNLESS OTHERWISE NOTED, DEVICES SHALL BE INSTALLED AS FOLLOWS (ABOVE FINISHED FLOOR):

- 8.1.1 RECEPTACLES-GENERAL 400MM.

- 8.1.2 RECEPTACLES-ABOVE COUNTER 150MM. (OR ABOVE SPLASH BACKS)

- 8.1.3 PANELBOARDS-TO TOP 1800MM.

- 8.1.4 SWITCHES-1200MM.

- 8.1.5 TELEPHONE OUTLETS-400MM.

- 8.1.6 TELEVISION OUTLETS-400MM.

- 8.1.7 FIRE ALARM PANEL-TO TOP 1800MM. CLEAR SPACE IN FRONT OF THE PANEL EQUAL TO THE WIDTH OF THE DOOR BUT NOT LESS THAN 1000MM.

- 8.1.8 MANUAL PULL STATIONS-1100MM ABOVE THE FINISHED FLOOR LEVEL MEASURED TO THE CENTRE OF THE MANUAL STATION. WHERE POSSIBLE, INSTALL ON THE LATCH SIDE OF A SINGLE DOOR AT A MAXIMUM LATERAL DISTANCE OF 1500MM FROM THE DOOR OPENING. SHALL BE INSTALLED SO AS TO BE VISIBLE AND ACCESSIBLE AT ALL TIMES.

- 8.1.9 FIRE ALARM STROBE LIGHT AND STROBE LIGHT W/ HORN-2300MM.

- 8.2 ELECTRICAL DEVICES LOCATED IN OFFICES SHALL BE MOUNTED ABOVE DESK HEIGHT TO SUIT OWNER'S REQUIREMENTS. ELECTRICAL CONTRACTOR SHALL CONFIRM WITH OWNER FOR EXACT MOUNTING HEIGHT AND LOCATIONS.

9 BRANCH CIRCUIT WIRING

- 9.1 SHALL CONSIST OF WIRING CONDUCTORS INSTALLED IN CONDUIT OR ARMORED CABLE.

- 9.2 WHERE SPECIFICALLY CALLED FOR, CONDUIT SHALL BE RUN EXPOSED.

- 9.3 WIRING IN METAL STUD PARTITIONS ONLY MAY BE TYPE AC-90 CABLE SECURED AT EACH STUD TO PREVENT RATTLING. CONDUIT MUST BE USED FROM CEILING TO FIRST OUTLET BOX IN WALL IN METAL STUD.

- 9.4 ALL FIRE-RATED ASSEMBLIES MUST BE MAINTAINED ACCORDING TO BUILDING CODE REQUIREMENTS. SEE ARCHITECTURAL DRAWINGS AND/OR CODE SUMMARY PAGE FOR THE LOCATION OF FIRE-RATED ASSEMBLIES.

- 9.5 WIRING IN PLENUM SPACE CREATED BY A SUSPENDED CEILING TO BE WITH ELECTRICAL METALLIC TUBING, AND FLEXIBLE CORD LISTED IN CEC TABLE 11 FOR HARD USAGE NOT EXCEEDING 3 M IN LENGTH AND TERMINATED WITH AN ATTACHMENT PLUS SHELL BE PERMITTED TO SUPPLY POLE-TYPE MULTI-OUTLET ASSEMBLIES.

10 LOW VOLTAGE WIRING

- 10.1 TERMINATE AND TEST ALL CATEGORY 6 UTP CABLES BETWEEN OUTLET LOCATIONS AND PATCH PANEL ON CABLE RACK INSIDE COMMUNICATIONS ROOM.

- 10.2 PROVIDE AMP OFFICE OUTLET COMPONENTS SUCH AS TWO- OR FOUR-PORT SINGLE-GANG FACEPLATES (AMP #557505-01 FOR TWO PORTS, AND AMP #558088-1 FOR FOUR PORTS), AND BLUE RJ-45 INSERTS (AMP #1375055-5), AS REQUIRED.

- 10.3 IF THE UTP CABLE ROUTE REQUIRES BENDING, BE SURE TO MAINTAIN A BEND RADIUS THAT IS FOUR (4) TIMES THE DIAMETER OF THE CABLE.

- 10.4 ALL UTP CABLES ARE TO BE INSTALLED USING STRAIN-RELIEF BARS OR CABLING SUPPORT BARS, WIRE MANAGEMENT PANELS, AND VELCRO CABLE TIE WRAPS. UTP CABLES ARE TO BE INSTALLED ON EACH PATCH PANEL.

- 10.5 TO REDUCE ELECTROMAGNETIC INTERFERENCE, AVOID ROUTING UTP CABLES NEAR LIGHTING BALLASTS, POWER CABLES, AND MOTORS (RECOMMENDED DISTANCES OF 300 MM TO ONE (1) METRE FROM VARIOUS EQUIPMENT). POWER CABLES SHALL NOT BE ALLOWED IN THE COMMUNICATIONS CONDUIT.

- 10.6 USE 1" OR 3/4" CONDUIT TO ROUTE THE CAT-6 UTP CABLES TO THE WALL OUTLET BOXES THAT REQUIRE EXTRA MECHANICAL PROTECTION.

- 10.7 IDENTIFY AND TAG ALL CABLES WITH A CABLE NUMBER IN THE CONTROL ROOM AND IN THE COMMUNICATIONS ROOM.

- 10.8 PERFORM A CATEGORY-6 CHANNEL AUTO-TEST ON ALL CABLES USING A FLUKE DTX-1800 CABLE ANALYZER OR EQUIVALENT TEST SET. TEST AND RECORD THE LENGTHS OF ALL CABLES TO VERIFY CAT-6 COMPLIANCE.

- 10.9 CONTRACTOR SHALL REPLACE OR RE-PULL ANY UTP CABLES THAT FAIL THE CAT-6 CABLE TESTS.

11 CONDUIT

- 11.1 CONDUIT IN POURED CONCRETE SLABS SHALL BE RIGID PVC.

- 11.2 USE RIGID STEEL CONDUIT ONLY WHERE REQUIRED BY CODE.

- 11.3 ALL OTHER CONDUIT SHALL BE EMT.

- 11.4 THE CONTRACTOR IS RESPONSIBLE FOR THE ROUTING OF ALL CONDUIT AND THE FINAL ROUTING OF ALL CONDUIT RUNS SHALL BE CLEARLY SHOWN ON THE "AS-INSTALLED" DRAWINGS.

- 11.5 CONDUIT SHALL BE SIZED IN ACCORDANCE WITH CURRENT CODE REGULATIONS EXCEPT WHERE SPECIFIED SIZED ARE CALLED FOR. ALL HOME RUNS SHALL NOT BE LESS THAN 19MM (3/4").

- 11.6 EXPOSED CONDUIT SHALL BE RUN SQUARE TO THE BUILDING LINES AND SECURED BY MEANS OF APPROVED STRAPS AT INTERVALS NOT GREATER THAN 1500MM.

- 11.7 AT OUTLET BOXES AND JUNCTION BOXES, TWO LOCKNUTS AND INSULATED BUSHINGS OR THROAT CONNECTORS SHALL BE EMPLOYED.

- 11.8 CONDUIT STUBBED UP DURING BUILDING CONSTRUCTION SHALL BE SECURELY CAPPED TO PREVENT THE ENTRANCE OF FOREIGN MATTER. ALL CONDUIT RUNS SHALL BE THOROUGHLY CLEANED PRIOR TO THE PULLING IN OF ANY WIRING CONDUCTORS.

- 11.9 INSTALL PULL WIRE OR CORD IN ALL EMPTY CONDUIT RUNS.

- 11.10 INSTALL LENGTHS OF FLEXIBLE CONDUIT BETWEEN TERMINATING POINT OF CONDUIT OR JUNCTION BOX AND MOTORS.

- 11.11 WHEN CONDUCTORS/CABLES ARE INSTALLED IN CONDUITS ON ROOFS, EMT CONDUIT TO BE PROVIDED C/W LIQUID TIGHT COUPLINGS.

- 11.12 CONDUITS, TEC CABLES, AC90, ACWU AND ALUMINUM SHEATHED CABLES ON ROOFS TO BE INSTALLED ON ALUMINUM CABLE TRAY.

- 11.13 CABLE TRAYS AND EMT CONDUITS TO BE INSTALLED ON ROOF TOP RUBBER SUPPORTS. UNISTRUT CHANNELS TO BE PROVIDED AS REQUIRED.

- 11.14 ROOF PENETRATIONS TO BE PROVIDED WITH ROOF FLASHINGS SPECIFICALLY MADE FOR ELECTRICAL CABLE AND CONDUIT PENETRATIONS. ROOF FLASHINGS TO BE INSTALLED BY A ROOFING CONTRACTOR.

12 WIRING CONNECTORS

- 12.1 USE PRESSURE TYPE CONNECTORS ON CONDUCTORS #8 AWG OR LARGER.

- 12.2 MAKE JOINTS IN BRANCH WIRING #10 AWG AND SMALLER USING TWIST-ON EXPANDING SPRING INSULATED CONNECTORS OF THE APPROPRIATE SIZE.

13 WIRING CONDUCTORS

- 13.1 ALL WIRE SHALL BE COPPER, MINIMUM SIZE #12.

14 IDENTIFICATION OF CONDUCTORS

- 14.1 ALL CONDUCTORS SHALL BE COLOUR CODED AND SHALL BE IDENTIFIED WITH IDENTIFYING MARKERS.

15 TYPE AC CABLE

- 15.1 SHALL BE 2, 3 AND 4 CONDUCTOR TYPE AC-90, X-LINK COPPER, 600V INSULATION.

- 15.2 TYPE AC CABLE SHALL BE CONNECTED TO KNOCKOUTS IN THE SIDES OF THE BOXES AND NOT IN THE COVER.

16 PVC DUCT

- 16.1 SHALL BE TYPE 2 DIRECT BURIED. FOR TELEPHONE INSTALLATION, WHITE OR 2 DUCTS SHALL BE USED.

- 16.2 ALL COUPLINGS SHALL BE PROPERLY CEMENTED.

- 16.3 BENDS SHALL BE FACTORY MADE OR FIELD FABRICATED WITH MANUFACTURER'S APPROVED HEATING DEVICE.

17 OUTLET BOXES

- 17.1 INSTALL ALL OUTLET BOXES FLUSH WITH THE FINISHED SURFACE WHERE CONDUIT IS CONCEALED.

- 17.2 OUTLET BOXES THAT PENETRATE A VERTICAL FIRE SEPARATION OR A MEMBRANE FORMING PART OF A FIRE RATED ASSEMBLY SHALL NOT EXCEED 0.016 M2 IN AREA AND AN AGGREGATE AREA OF 0.065M2 IN ANY 9.3M2 OF SURFACE AREA.

- 17.3 OUTLET BOXES ON OPPOSITE SIDES OF A VERTICAL FIRE SEPARATION WALL HAVING A FIRE RESISTANCE RATING SHALL BE SEPARATED BY A HORIZONTAL DISTANCE OF NOT LESS THAN 600 MM.

- 17.4 WHERE CONDUIT IS INSTALLED, BOXES SHALL BE 100MM (4") OCTAGONAL PRESSED STEEL, WITH KNOCKOUTS AND COVERED WITH A PLATE OR FIXTURE CANOPY.

18 SWITCH AND RECEPTACLE BOXES

- 18.1 INSTALLED FLUSH IN ALL WALL SURFACES EXCEPT WHERE SURFACE CONDUIT IS SPECIFIED.

- 18.2 BOXES SHALL BE NON-SECTIONAL, SIZED FOR THE CORRECT NUMBER OF GANGS AS REQUIRED. WHERE MORE THAN ONE CONDUIT ENTERS FROM ANY DIRECTION, BOXES SHALL NOT BE LESS THAN 102 X 102 (4"X4") C/W PLASTER RINGS AS REQUIRED.

- 18.3 THE SAFETY SWITCH BOX (NOT THE HANDLE) MUST BE LOCKED BY ONE DEVICE (PADLOCK) AND TO BE MANAGED BY THE APPOINTED ELECTRICIAN.

19 SUPPORTS AND HANGERS

- 19.1 SUPPORT AND ANCHOR ALL ELECTRICAL EQUIPMENT TO ENSURE PROPER RIGIDITY AND ALIGNMENT DURING AND AFTER CONSTRUCTION.

- 19.2 PROVIDE TOGGLE BOLTS FOR HOLLOW MASONRY, PLASTER OR DRYWALL CONSTRUCTION. PRESET OR EXPANSION ANCHORS FOR SOLID MASONRY, POURED CONCRETE, ETC. MACHINE SCREWS, BOLTS, WELD STUDS FOR METAL, WOOD SCREWS FOR WOOD, ETC.

20 LOCATION OF DEVICE OUTLETS

- 20.1 THE FINISHED APPEARANCE OF THE BUILDING IS CRITICAL. ALIGN THE BOXES SO THAT THE CENTRE LINE OF THE FINISHED DEVICE IS HORIZONTALLY AND/OR VERTICALLY ALIGNED WITH ADJACENT DEVICES. VERIFY ALL FINAL LOCATIONS WITH THE ENGINEER.

21 LINE VOLTAGE SWITCHES

- 21.1 RATED 20 AMPERES 120/127 VOLTS AC, WHITE BODIES, EQUIVALENT TO THOSE MANUFACTURED BY LEVITON.

22 RECEPTACLES

- 22.1 WHITE DECORA BODIES, COMMERCIAL TYPE, EQUIVALENT TO THOSE MANUFACTURED BY LEVITON. RECEPTACLES SHALL HAVE A METAL WALL PLATE.

- 22.2 CONNECT THE GROUND TERMINAL TO THE CIRCUIT BY #14 GREEN OR BARE WIRE. THE RECEPTACLE AND BOX SHALL BE COMPLY BONDED.

- 22.3 RECEPTACLES WITHIN DWELLING UNITS SHALL BE TAMPER RESISTANT EXCEPT WHERE THEY ARE DEDICATED FOR STATIONARY APPLIANCES SUCH THAT THE RECEPTACLE IS RENDERED INACCESSIBLE.

- 22.4 RECEPTACLES WITHIN CARE, PRESCHOOLS, AND ELEMENTARY EDUCATION FACILITIES SHALL BE TAMPER RESISTANT EXCEPT WHERE THEY ARE DEDICATED FOR STATIONARY APPLIANCES SUCH THAT THE RECEPTACLE IS RENDERED INACCESSIBLE.

- 22.5 RECEPTACLES REQUIRED FOR MAINTENANCE OF EQUIPMENT LOCATED ON ROOFTOPS SHALL BE OF CSA CONFIGURATION 5-20R, GFCI PROTECTED, ON A SEPARATE BRANCH CIRCUIT, LOCATED WITHIN 7.5M OF THE ELECTRICAL EQUIPMENT, LOCATED NO LESS THAN 750MM ABOVE THE FINISHED ROOF, AND PROTECTED FROM MECHANICAL DAMAGE.

- 22.6 RECEPTACLES EXPOSED TO THE WEATHER SHALL BE PROVIDED WITH WET LOCATION COVERPLATES AND MARKED "EXTRA DUTY".

23 PLATES

- 23.1 SURFACE MOUNTED DEVICES SHALL BE FITTED WITH CADMIUM PLATED SHEET STEEL PLATES WITH ROLLED EDGES.

- 23.2 MULTI-GANG PLATES SHALL BE OF ONE PIECE CONSTRUCTION.

- 23.3 WEATHERPROOF PLATES SHALL BE BRYANT 4500B OR SIMILAR.

24 INCOMING SERVICES

- 24.1 TENDER PRICE IS TO INCLUDE ALL EQUIPMENT REQUIRED FOR THE SERVICE AS SHOWN ON THE DRAWINGS.

- 24.2 CONTRACTOR SHALL COORDINATE WITH SUPPLY AUTHORITIES TO PROVIDE CONNECTION. SUPPLY AUTHORITY CHARGES WILL BE PAID DIRECTLY BY CONTRACTOR.

25 GROUNDING

- 25.1 CONNECT NEUTRAL BAR, MAIN SWITCH ENCLOSURE, AND ALL ELECTRICAL EQUIPMENT TO GROUNDING ELECTRODE.

- 25.2 CHECK RESISTANCE TO GROUND. IF RESISTANCE TO GROUND IS GREATER THAN 10 OHMS, THEN ADDITIONAL ELECTRODES SHALL BE INSTALLED UNTIL A RESISTANCE OF LESS THAN 10 OHMS IS ACHIEVED.

- 25.3 SUPPLY AND INSTALL A GROUND WIRE.

- 25.4 ALL GROUNDING OR BONDING CONDUCTORS RUN ON FOUNDATIONS SHALL BE FASTENED USING COPPER CLIPS.

- 25.5 STRANDED COPPER CONDUCTORS SHALL BE BENT USING PROPER GROUNDING SPRINGS.

- 25.6 ALL GROUNDING OR BONDING CONDUCTORS RUN ON FOUNDATIONS SHALL BE INSTALLED SO AS NOT TO POSE ANY TRIPPING HAZARDS.

- 25.7 FASTENING OF GROUNDING OR BONDING CONDUCTORS ONTO FOUNDATION SHALL BE DONE USING 1/4" HELIX QUICK BOLTS.

- 25.8 ALL GROUNDING OR BONDING CONDUCTOR COMPRESSION CONNECTIONS SHALL BE MADE TO ENSURE THAT INDIVIDUAL STRANDS DO NOT PUSH OUT OF THE CONNECTION.

- 25.9 ALL CONTROL CABLES SHALL BE GROUNDED USING APPROVED LUG, CRIMP AND CRIMPING TOOLS.

26 PANELBOARDS

- 26.1 ALL PANELBOARDS SHALL BE BY ONE MANUFACTURER AND SHALL BE OF THE CIRCUIT BREAKER TYPE.

- 26.2 PANELBOARD SHALL BE COMPLETE WITH LUGS ONLY IN THE MAINS, CONSTRUCTED IN EEMAC STANDARDS COMPLETE WITH HINGED DOOR IN TRIM.

- 26.3 INTERRUPTING CAPACITY TO BE CONFIRMED BY UTILITY SERVICE DEPARTMENT. IN A SERIES RATED SYSTEM SEE SECTION 32 OF THESE SPECIFICATIONS.

- 26.4 MULTI-POLE BREAKERS SHALL HAVE COMMON TRIPPING ELEMENTS OPERATED BY A SINGLE HANDLE. SEQUENCE BREAKERS OR AGREE WITH THE CIRCUITING AS SHOWN ON THE DRAWING. IDENTIFY EACH BREAKER CLEARLY WITH THE CIRCUIT NUMBER.

- 26.5 COMPLETE CIRCUIT DIRECTORY WITH PRINTED LEGEND INDICATING LOCATION AND LOAD OF EACH CIRCUIT. THIS DIRECTORY SHOULD BE MOUNTED IN PLASTIC ENVELOPE INSIDE OF PANEL DOOR.

- 26.6 UNLESS OTHERWISE NOTED, INSTALL THE TOP OF THE PANELBOARD AT 1800MM (6') ABOVE THE FLOOR.

27 LIGHT FIXTURES

- 27.1 ALL LIGHT FIXTURES SHALL BE INSTALLED BY THE ELECTRICAL CONTRACTOR.

- 27.2 ALL LIGHT FIXTURES SHALL BE ENERGY STAR CERTIFIED OR APPROVED BY DESIGNLIGHTS CONSORTIUM.

- 27.3 LIGHTING FIXTURES SHALL BE COMPLETE WITH ALL NECESSARY ACCESSORIES AND LAMPS AND BE SUITABLE FOR INSTALLATION IN OR ON CEILINGS. WHERE THEY OCCUR, PENDANT FIXTURES SHALL BE SECURELY ANCHORED TO THE BUILDING STRUCTURE.

- 27.4 CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL CEILING TYPES WITH THE CONTRACT DRAWINGS BEFORE ORDERING FIXTURES AND FOR ADJUSTING CATALOGUE NUMBERS ACCORDINGLY.

28 TELEPHONE AND LOW VOLTAGE SYSTEMS

- 28.1 CONTRACTOR SHALL COORDINATE WITH SUPPLY AUTHORITY FOR INCOMING TELEPHONE SUPPLY. CHARGES SHALL BE PAID DIRECTLY BY THIS CONTRACTOR. THE COMPLETE INSTALLATION SHALL BE TO TELEPHONE AUTHORITIES APPROVAL.

- 28.2 PROVIDE AND INSTALL A COMPLETE SYSTEM NETWORK INCLUDING OUTLET BOXES, COVER PLATE, BIX CONNECTORS, CONDUITS, WIRE WAY, CABLES, AND ALL ACCESSORIES.

- 28.3 CABLE TO BE BOD, TYPE SE, 4 PAIRS.

- 28.4 TELEPHONE JACK TO BE LEVITON MODULE RJ11 # 40249-W.

- 28.5 TV JACK TO BE LEVITON MODULE RG6 # 80781-W.

- 28.6 MAKE CONNECTIONS AT BOTH ENDS OF TELEPHONE AND TV CABLE, MAKE IDENTIFICATION ON CABLE AT BOTH ENDS AS PER OWNERS INSTRUCTION AND PERFORM PROPER TEST TO HAVE A GOOD SIGNAL.

- 28.7 BOTH TV AND TELEPHONE CABLES MUST BE ONE CONTINUOUS LENGTH, WITHOUT ANY SPLICE JOINT FROM MAIN ENTRANCE BOARD TO THE WALL OUTLET.

- 28.8 CONTRACTOR IS RESPONSIBLE TO INSTALL LOW VOLTAGE SYSTEMS. REQUIRED DEVICES AND LOCATIONS TO BE CONFIRMED WITH THE OWNER.

- 29 LABELING AND TAGGING OF ALL OUTLETS, SWITCHES, AND DISCONNECTS.

- 29.1 CABLES SHALL BE LABELED AT BOTH ENDS.

- 29.2 SPARE WIRES IN PANELS AND EQUIPMENT SHALL BE MARKED AND IDENTIFIED WITH THE SPECIFIC CABLE NUMBER.

- 29.3 PROTECTIVE RELAYING GROUNDS SHALL BE CLEARLY IDENTIFIED TO DIFFERENTIATE THEM FROM EQUIPMENT AND CONTROL CABLE SHIELD GROUNDS.

- 29.4 ALL CABLES SHALL BE IDENTIFIED USING CABLE TAGS. CABLE TAGS SHALL BE NONCONDUCTIVE. LETTERING SHALL BE A MINIMUM OF FIVE MILLIMETERS (5 MM) IN HEIGHT. WIRES SHALL BE IDENTIFIED USING PRE-PRINTED LABELS. THE CONTRACTOR SHALL SUBMIT A SAMPLE OF CABLE TAGS AND WIRE LABELS TO THE ENGINEER FOR APPROVAL 15 DAYS PRIOR TO INSTALLATION AT THE SITE.

- 29.5 ALL RECEPTAC