

### BASIC ELECTRICAL MATERIALS & METHODS

### PART 1 — GENERAL

- 1.1 RELATED DOCUMENTS
- A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 1 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.
- A. ALTERNATES: AS LISTED IN DOCUMENT WITH THE EXTENT OF, IF ANY, WORK OF THIS SECTION THAT
- WILL BE AFFECTED BY ANY ALTERNATES IF ACCEPTED. B. FURNISH ALL MATERIALS, EQUIPMENT, LABOR, AND SUPPLIES AND PERFORM ALL OPERATIONS NECESSARY TO COMPLETE THE ELECTRICAL WORK IN ACCORDANCE WITH THE INTENT OF THE DRAWINGS
- C. EXISTING CONDUIT CAN BE USED FOR NEW WIRING METHODS IF ACCEPTABLE. ALL ABANDONED CONDUIT WILL BE REMOVED TO THE NEXT JUNCTION BOX. ALL EXISTING WIRING SHALL BE REMOVED.

## 1.3 QUALITY ASSURANCE

AND THESE SPECIFICATIONS

- A. ALL WIRING SHALL BE IN ACCORDANCE WITH THE LATEST ISSUE OF THE NATIONAL ELECTRICAL CODE,
- STATE OF MAINE, AND LOCAL CODES. B. THE SERVICE EQUIPMENT SHALL BE GROUNDED AT THE SERVICE ENTRANCE SWITCH ENCLOSURE. THIS SHALL ALSO BE THE GROUNDING POINT FOR THE SERVICE CONDUIT, BOXES, FITTINGS AND METAL ENCLOSED EQUIPMENT USED IN THE BUILDING WIRING SYSTEM. ANY GROUNDING METHODS ALLOWED
- C. THE CONTRACTOR SHALL SHOW EVIDENCE, UPON REQUEST, OF HAVING SUCCESSFULLY COMPLETED AT LEAST FIVE SIMILAR PROJECTS. INSTALLATION OF EACH SYSTEM SHALL BE UNDER THE SUPERVISION

UNDER ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE MAY BE USED PROVIDED THE GROUND

OF A FACTORY-AUTHORIZED ORGANIZATION (FACTORY AUTHORIZATION BY OWNER). D. THE CONTRACTOR SHALL SHOW EVIDENCE, UPON REQUEST, THAT HE MAINTAINS A FULLY EQUIPPED

RESISTANCE IS LESS THAN 25 OHMS. THIS RESISTANCE SHALL BE TESTED.

SERVICE ORGANIZATION CAPABLE OF FURNISHING ADEQUATE INSPECTION AND SERVICE TO THE SYSTEM. E. ALL ELECTRICAL EQUIPMENT SHALL BE APPROVED BY UNDERWRITERS LABORATORIES, INC. EACH SYSTEM SHALL BE PRODUCTS OF A SINGLE MANUFACTURER OF ESTABLISHED REPUTATION AND EXPERIENCE. THE CONTRACTOR SHALL HAVE SUPPLIED SIMILAR APPARATUS TO COMPARABLE INSTALLATIONS RENDERING SATISFACTORY SERVICE FOR AT LEAST THREE YEARS.

- A. PROVIDE POWER AND CONTROL WIRING FOR ALL NEW HVAC EQUIPMENT, ALL EQUIPMENT TO BE POWERED FROM THE EXISTING ELECTRICAL DISTRIBUTION SYSTEM.
- B. PRIOR TO SUBMISSION FOR REVIEW OF ANY ITEM OF EQUIPMENT, DETERMINE WHETHER OR NOT IT WILL FIT IN THE SPACE PROVIDED. ANY CHANGES IN THE SIZE OR LOCATION OF THE MATERIAL OR EQUIPMENT SUPPLIED WHICH MAY BE NECESSARY IN ORDER TO MEET FIELD CONDITIONS OR IN ORDER TO AVOID CONFLICTS BETWEEN TRADES, SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE PROJECT MANAGER AND APPROVAL RECEIVED BEFORE SUCH ALTERATIONS ARE MADE.

## 1.5 SUBMITTALS

- A. FURNISH THE FOLLOWING:
- MANUFACTURER'S DESCRIPTIVE LITERATURE: FOR EACH TYPE OF PRODUCT INDICATED. SUBMIT SHOP DRAWINGS THAT INCLUDE ENGINEERING DRAWINGS OF THE SYSTEM WITH SPECIFICATION SHEETS COVERING ALL COMPONENT PARTS OF THE SYSTEM AND INTERCONNECTION DIAGRAMS. THE FOLLOWING EQUIPMENT REQUIRE SUBMITTALS:
  - a. GFCI AND AFCI RECEPTACLES b. ELEVATOR CIRCUIT BREAKER
- c. ELEVATOR CONTROL ROOM DEVICES AND EQUIPMENT
- d. MAGNETIC MOTOR STARTERS

### e. MOTOR SWITCHES CERTIFICATION

- a. PRIOR TO FINAL INSPECTION, DELIVER TO THE OWNER'S REPRESENTATIVE FOUR (4) COPIES OF CERTIFICATION THAT THE MATERIAL IS IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS AND HAS BEEN PROPERLY INSTALLED.
- b. SUBMIT CERTIFICATION OF SYSTEM OPERATING TEST. MANUALS: SUBMIT COPIES OF COMPLETE SET OF OPERATING INSTRUCTIONS INCLUDING CIRCUIT DIAGRAMS AND OTHER INFORMATION OF SYSTEM COMPONENTS. SUPPLY SIX COMPLETE SETS OF EACH.

## 1.6 PROJECT CONDITIONS

- A. REGULATORY REQUIREMENTS:
- CONFORM TO THE REQUIREMENTS OF ALL LAWS AND REGULATIONS APPLICABLE TO THE WORK. COOPERATE WITH ALL AUTHORITIES HAVING JURISDICTION.
- COMPLIANCE WITH LAWS AND REGULATIONS GOVERNING THE WORK ON THIS PROJECT DOES NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH MORE RESTRICTIVE REQUIREMENTS CONTAINED IN
- 4. IF THE CONTRACT DOCUMENTS ARE FOUND TO BE AT VARIANCE WITH ANY LAW OR REGULATION, THE CONTRACTOR SHALL NOTIFY THE ENGINEER/OWNER PROMPTLY IN WRITING. THE CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR ANY WORK CONTRARY TO LAW OR REGULATION, AND SHALL BEAR ALL COSTS FOR THE CORRECTIONS THEREOF.
- 5. MINIMUM REQUIREMENTS: THE NATIONAL ELECTRICAL CODE (NEC), UNDERWRITERS LABORATORIES, INC. (UL). THE NATIONAL FIRE CODES, AND NATIONAL FIRE PROTECTION ASSOCIATION (NEPA) ARE A MINIMUM REQUIREMENT FOR WORK UNDER THIS SECTION. DESIGN DRAWINGS AND OTHER SPECIFICATION SECTIONS SHALL GOVERN IN THOSE INSTANCES WHERE REQUIREMENTS ARE GREATER THAN THOSE
- SPECIFIED IN THE NEC. 6. CONFORM AND ADHERE TO ALL OSHA AND STATE SAFETY REGULATIONS AND REQUIREMENTS.
- B. PERMITS, FEES, AND INSPECTIONS:
- 1. SECURE AND PAY FOR ALL PERMITS, FEES, LICENSES, INSPECTIONS, ETC., REQUIRED FOR THE WORK
- 2. SCHEDULE AND PAY FOR ALL LEGALLY REQUIRED INSPECTIONS AND COOPERATE WITH INSPECTING
- 3. PROVIDE CERTIFICATES OF INSPECTION AND APPROVAL FROM ALL REGULATORY AUTHORITIES HAVING JURISDICTION OVER THE WORK WHERE APPLICABLE.

- 1. DO NOT SCALE THE DRAWINGS. THE GENERAL LOCATION OF THE APPARATUS AND THE DETAILS OF THE WORK ARE SHOWN ON THE DRAWINGS, WHICH FORM A PART OF THIS SPECIFICATION. EXACT LOCATIONS ARE TO BE DETERMINED AT THE BUILDING AS THE WORK PROGRESSES, AND SHALL BE SUBJECT TO THE ENGINEER'S/OWNER'S APPROVAL. ACTUAL FIELD CONDITIONS SHALL GOVERN ALL DIMENSIONS.
- ANYTHING SHOWN ON THE DRAWINGS AND NOT MENTIONED IN THE SPECIFICATIONS OR VICE VERSA SHALL BE FURNISHED AS IF IT WERE BOTH SHOWN AND SPECIFIED. 3. IT IS NOT INTENDED THAT THE DRAWINGS SHALL SHOW EVERY WIRE, DEVICE, FITTING, CONDUIT OR APPLIANCE, BUT IT SHALL BE A REQUIREMENT TO FURNISH WITHOUT ADDITIONAL EXPENSE, ALL MATERIAL AND LABOR NECESSARY TO COMPLETE THE SYSTEMS IN ACCORDANCE WITH THE NEC AND
- A. THE CONTRACTOR SHALL GUARANTEE ALL EQUIPMENT AND WIRING FREE FROM INHERENT MECHANICAL OR ELECTRICAL DEFECTS FOR TWO YEARS FROM DATE OF ACCEPTANCE.

### PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

THE BEST PRACTICE OF THE TRADE.

- A. MANUAL MOTOR SWITCHES: 20A, 120V, 1-POLE, IVORY SPECIFICATION GRADE.
- B. DUPLEX RECEPTACLES WITH GROUND\_FAULT INTERRUPTER AND ARC-FAULT INTERRUPTER SHALL BE AN INTEGRAL UNIT SUITABLE FOR MOUNTING IN A STANDARD OUTLET BOX.
- GROUND\_FAULT AND ARC-FAULT INTERRUPTER SHALL CONSIST OF A DIFFERENTIAL CURRENT TRANSFORMER, SOLID STATE SENSING CIRCUITRY AND A CIRCUIT INTERRUPTER SWITCH. IT SHALL BE RATED FOR OPERATION ON A 60 HZ, 120-VOLT, 20-AMPERE BRANCH CIRCUIT. DEVICE SHALL HAVE NOMINAL SENSITIVITY TO GROUND LEAKAGE CURRENT OF FIVE MILLIAMPERES AND SHALL FUNCTION TO INTERRUPT THE CURRENT SUPPLY FOR ANY VALUE OF GROUND LEAKAGE CURRENT ABOVE FIVE MILLIAMPERES ON THE LOAD SIDE OF THE DEVICE. DEVICE SHALL HAVE A MINIMUM NOMINAL TRIPPING TIME OF 1/30TH OF A SECOND.
- RECEPTACLE SHALL BE RATED 20 AMPERES, 125 VOLTS FOR INDOOR USE AND SHALL BE THE STANDARD DUPLEX, THREE-WIRE, GROUNDING TYPE.
- C. BOXES SHALL BE STEEL AND MINIMUM SIZE REQUIRED BY NEC.
- D. DISCONNECT SWITCHES SHALL BE HEAVY-DUTY TYPE, HORSEPOWER RATED AND RATED FOR THE ENVIRONMENT. E. WIRING MATERIALS:
- 1. WIRING SHALL BE ENCLOSED IN ELECTRICAL RIGID GALVANIZED STEEL, INTERMEDIATE METAL CONDUIT,
- ELECTRICAL METALLIC TUBING OR FLEXIBLE METALLIC TUBING SIZED IN ACCORDANCE WITH CODE REQUIREMENTS FOR THE CONDUCTORS. TYPES MC OR NM CABLE MAY BE USED WHERE CONCEALED IN WALLS OR CEILINGS AND ALLOWED BY CODE. a. CONDUIT FITTINGS SHALL BE STEEL COMPRESSION TYPE.
  - b. TERMINATIONS FOR ALL CONDUITS SHALL HAVE INSULATED BUSHINGS OR INSULATED THROAT CONNECTORS IN ACCORDANCE WITH CODE REQUIREMENTS.
- c. ALL CONDUITS SHALL BE SUBSTANTIALLY SUPPORTED WITH APPROVED CLIPS OR HANGERS SPACED NOT TO EXCEED TEN FEET ON CENTER. MINIMUM CONDUIT SIZE SHALL BE 1/2". 2. FLEXIBLE METAL CONDUIT SHALL BE USED FOR ALL CONNECTIONS TO MOTORS AND VIBRATING
- EQUIPMENT AND SHALL COMPLY WITH FED. SPEC. WW-C-566. 3. LIQUID\_TIGHT FLEXIBLE METAL CONDUIT SHALL CONSIST OF FLEXIBLE STEEL CONDUIT WITH A LIQUID\_TIGHT PVC JACKET OVER THE CONDUIT.
- a. FITTINGS SHALL INCORPORATE A THREADED GROUNDING CONE, A STEEL OR PLASTIC COMPRESSION RING, AND A GLAND FOR TIGHTENING.
- b. LIQUID-TIGHT FLEXIBLE METAL CONDUIT SHALL BE USED IN DAMP OR WET LOCATIONS WHEN FLEXIBLE METAL CONDUIT WOULD OTHERWISE BE USED. c. LIQUID-TIGHT FLEXIBLE METAL CONDUIT SHALL NOT PENETRATE THE ROOF OR EXTERIOR
- WALLS, AND SHALL NOT BE INSTALLED IN LENGTHS EXCEEDING 72" EXCEPT WHERE NECESSARY FOR FLEXIBILITY. 4. NONMETALLIC CONDUIT: FED. SPEC. W\_C\_1094, TYPE II OR TYPE III SHALL APPLY. CONDUIT SHALL BE SCHEDULE 40 HEAVY WALL PVC OR HIGH DENSITY PE. CONDUIT SHALL BE UL LISTED FOR USE
- ABOVE GROUND AND DIRECT BURIAL UNDERGROUND AND BE SUNLIGHT RESISTANT . ALL WIRING SHALL BE TYPE THW, XHHW, OR THHN, UL LABELED, COPPER CONDUCTORS WITH 600-VOLT INSULATION, EXCEPT AS OTHERWISE NOTED. MINIMUM SIZE WIRE SHALL BE NO. 18 AWG.
- 6. NONMETALLIC—SHEATHED CABLE (TYPE NM) SHALL BE TWO—OR THREE—CONDUCTOR WITH A GROUND CONDUCTOR AND AN OVERALL COVERING THAT IS FLAME-RETARDANT AND MOISTURE-RESISTANT. MINIMUM WIRE SIZE SHALL BE NO. 18 AWG.
- 7. TYPE MC CABLE SHALL HAVE MINIMUM NO. 18 AWG TYPE THWN OR XHHW INSULATED COPPER CONDUCTORS WITH AN INTERNAL BARE OR INSULATED COPPER GROUND WIRE. F. FIRE\_STOP MATERIAL:
- 1. FIRE\_STOPPING MATERIAL SHALL MAINTAIN ITS DIMENSION AND INTEGRITY WHILE PREVENTING THE PASSAGE OF FLAME, SMOKE, AND GASES UNDER CONDITIONS OF INSTALLATION AND USE WHEN EXPOSED TO THE ASTM E 119 TIME\_TEMPERATURE CURVE FOR A TIME PERIOD EQUIVALENT TO THE RATING OF THE ASSEMBLY PENETRATED. COTTON WASTE SHALL NOT IGNITE WHEN PLACED IN CONTACT WITH THE NON\_FIRE SIDE DURING THE TEST. FIRE\_STOPPING MATERIAL SHALL BE NONCOMBUSTIBLE AS DEFINED BY ASTM E 136; AND IN ADDITION FOR INSULATION MATERIALS, MELT POINT SHALL BE A

MINIMUM OF 17000F FOR ONE-HOUR PROTECTION AND 18500F FOR TWO-HOUR PROTECTION.

- 2. SEALS FOR FLOOR, EXTERIOR WALL, AND ROOF SHALL ALSO BE WATERTIGHT. G. GROUNDING CONDUCTORS:
- 1. GROUNDING CONDUCTORS SHALL BE SOFT-DRAWN BARE COPPER.
- 2. INSULATED GROUNDING WIRES SHALL BE UL AND NEC APPROVED TYPES, COPPER, WITH THHN OR XHHW INSULATION COLOR IDENTIFIED GREEN, EXCEPT WHERE OTHERWISE SHOWN ON THE DRAWINGS OR
- 3. WIRE SHALL NOT BE LESS THAN SHOWN ON THE DRAWINGS AND NOT LESS THAN REQUIRED BY THE
- H. GROUND CLAMPS:
- 1. GROUND CLAMPS SHALL BE CAST BRONZE OR CAST COPPER AND SHALL BE UL LISTED FOR GROUNDING CONNECTIONS.
- 2. GROUND CLAMPS SHALL BE SIZED FOR THE SPECIFIC CONDUCTOR AND ELECTRODE TO BE CLAMPED. I. GROUNDING CONNECTIONS: CONNECTIONS SHALL BE OF THE EXOTHERMIC TYPE WELDING PROCESS AS
- MANUFACTURER BY CALDWELD OR APPROVED EQUAL. J. EQUIPMENT GROUNDING CONNECTIONS: CONNECTIONS SHALL BE OF THE COMPRESSION TYPE SOLDER

## LESS CONNECTORS.

- K. PANELBOARDS: MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING:
- a. EATON ELECTRIC INC; CUTLER-HAMMER BUSINESS UNIT b. GENERAL ELECTRIC COMPANY; GE CONSUMER & INDUSTRIAL - ELECTRICAL DISTRIBUTION
- c. SQUARE D A BRAND OF SCHNEIDER ELECTRIC PANELBOARDS: NEMA PB 1. POWER AND FEEDER DISTRIBUTION TYPE
- 5. DOORS: SECURED WITH VAULT-TYPE LATCH WITH TUMBLER LOCK; KEYED ALIKE.
- a. FOR DOORS MORE THAN 36 INCHES (914MM) HIGH, PROVIDE TWO LATCHES, KEYED ALIKE.
- 4. MAINS: CIRCUIT BREAKER
- 5. BRANCH OVERCURRENT PROTECTIVE DEVICES FOR CIRCUIT-BREAKER FRAME SIZES 125 A AND SMALLER: BOLT-ON CIRCUIT BREAKERS.
- 6. BRANCH OVERCURRENT PROTECTIVE DEVICES FOR CIRCUIT-BREAKER FRAME SIZES LARGER THAN 125 A: BOLT-ON CIRCUIT BREAKERS; PLUG-IN CIRCUIT BREAKERS WHERE INDIVIDUAL POSITIVE-LOCKING DEVICE REQUIRES MECHANICAL RELEASE FOR REMOVAL.
- L. DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES
- MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE
- a. EATON ELECTRIC INC; CUTLER—HAMMER BUSINESS UNIT
- b. GENERAL ELECTRIC COMPANY; GE CONSUMER & INDUSTRIAL ELECTRICAL DISTRIBUTION c. SQUARE D - A BRAND OF SCHNEIDER ELECTRIC
- 1. CREATE A DIRECTORY TO INDICATE INSTALLED CIRCUIT LOADS AFTER BALANCING PANELBOARD LOADS; INCORPORATE OWNER'S FINAL ROOM DESIGNATIONS. OBTAIN APPROVAL BEFORE INSTALLING. USE A COMPUTER OR TYPEWRITER TO CREATE DIRECTORY: HANDWRITTEN DIRECTORIES ARE NOT ACCEPTABLE.
- 2. PANELBOARD NAMEPLATES: LABEL EACH PANELBOARD WITH A NAMEPLATE. 3. DEVICE NAMEPLATES: LABEL EACH BRANCH CIRCUIT DEVICE IN DISTRIBUTION PANELBOARDS WITH A NAMEPLATE.

## PART 3 - EXECUTION

3.1 INSTALLATION

ARCHITECT/ENGINEER.

- A. GENERAL 1. ALL WORK SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE'S REQUIREMENTS AS AMENDED TO DATE, WITH THE LOCAL ELECTRIC UTILITY COMPANY'S RULES, THE FIRE UNDERWRITER'S REQUIREMENTS, AND ALL LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS.
- 2. IN GENERAL, ALL WIRING IN FINISHED AREAS SHALL BE CONCEALED IN WALLS OR ABOVE CEILINGS. WHERE WIRING CANNOT BE CONCEALED DUE TO EXISTING CONSTRUCTION, EXPOSED WIRING SHALL BE INSTALLED IN CONDUIT OR SURFACE METAL RACEWAY AS INDICATED ON THE DRAWINGS. EXPOSED WIRING SHALL NOT BE INSTALLED IN FINISHED AREAS WITHOUT PRIOR WRITTEN AUTHORIZATION FROM
- THE OWNER. 3. CONDUITS SHALL BE OF SIZES REQUIRED BY THE NATIONAL ELECTRICAL CODE. EXPOSED CONDUITS SHALL BE INSTALLED WITH RUNS PARALLEL OR PERPENDICULAR TO WALLS AND CEILING, WITH RIGHT-ANGLE TURNS CONSISTING OF BENDS, FITTINGS, OR OUTLET BOXES. NO WIRE SHALL BE INSTALLED UNTIL WORK THAT MIGHT CAUSE DAMAGE TO WIRES OR CONDUITS HAS BEEN COMPLETED CONDUITS SHALL BE THOROUGHLY CLEANED OF WATER OR OTHER FOREIGN MATTER BEFORE WIRE IS
- 4. WHERE CONDUITS, WIREWAYS AND OTHER ELECTRICAL RACEWAYS PASS THROUGH FIRE PARTITIONS, FIRE WALLS, OR FLOOR, INSTALL A FIRE\_STOP THAT PROVIDES AN EFFECTIVE BARRIER AGAINST THE SPREAD OF FIRE. SMOKE AND GASES. FIRE\_STOP MATERIAL SHALL BE PACKED TIGHT AND COMPLETELY FILL CLEARANCES BETWEEN RACEWAYS AND OPENINGS. FLOOR, EXTERIOR WALL, AND ROOF SEALS SHALL
- 5. WHERE RACEWAYS PUNCTURE ROOF, COORDINATE WITH ROOFING CONTRACTOR AND PROJECT MANAGER. 6. SURFACE METAL RACEWAYS SHALL BE SIZED AS REQUIRED BY THE NATIONAL ELECTRICAL CODE AND AS RECOMMENDED BY THE MANUFACTURER. SURFACE METAL RACEWAYS SHALL BE INSTALLED WITH RUNS PARALLEL OR PERPENDICULAR TO WALLS AND CEILING. CHANGES IN DIRECTION SHALL ONLY BE MADE AT DEVICE BOX LOCATIONS OR WITH FITTINGS DESIGNED FOR THE PARTICULAR APPLICATION. INSTALLATION SHALL BE AS VISUALLY UNOBTRUSIVE AS POSSIBLE
- 7. ALL SPLICES SHALL BE MECHANICALLY AND ELECTRICALLY PERFECT, USING CRIMP TYPE WIRE CONNECTORS.
- 8. PROVIDE ALL DISCONNECT SWITCHES REQUIRED BY THE N.E.C. 9. MOUNT DISCONNECT SWITCHES AT A HEIGHT OF 60" ABOVE FINISHED FLOOR UNLESS OTHERWISE
- 10. LOCATE PANEL BOARDS SO THAT THE PRESENT AND FUTURE CONDUITS CAN BE CONVENIENTLY
- CONNECTED. 11. A TYPEWRITTEN SCHEDULE OF CIRCUITS, APPROVED BY THE OWNER'S REPRESENTATIVE SHALL BE ON THE PANEL DIRECTORY CARDS. TYPE THE ROOM NUMBERS AND ITEMS SERVED ON THE CARDS. THREE-COMPLETE SEPARATE COPIES OF ALL DIRECTORIES, NEATLY BOUND, SHALL BE DELIVERED TO THE OWNER'S REPRESENTATIVE.
- 12. REVISE EXISTING PANEL BOARD DIRECTORIES. FURNISH NEW CARDS AS NEEDED. DIRECTORIES SHALL BE TYPEWRITTEN OR PRINTED USING A COMPUTER.
- 13. MOUNT THE PANEL BOARD SO THAT MAXIMUM HEIGHT OF CIRCUIT BREAKERS ABOVE FINISHED FLOOR SHALL NOT EXCEED 78" 14. CIRCUIT NUMBERS INDICATED ON THE DRAWINGS ARE THE ACTUAL NUMBERS ASSIGNED TO THE CIRCUIT IN THE PANEL BOARD AND SHALL NOT BE VARIED WITHOUT THE CONSENT OF THE
- 15. PROVIDE ALL NECESSARY HARDWARE FOR MOUNTING PANEL BOARDS. 16. BRANCH CIRCUIT WIRING MAY BE NONMETALLIC-SHEATHED CABLE WHERE CONCEALED AND ALLOWED BY CODE, TYPE NM. NOTE: ALL NONMETALLIC CABLE SHALL BE PROPERLY SUPPORTED. (PROVIDE CONTINUOUS GROUND WIRE.)

- 17. UNDERGROUND WIRING MAY BE INSTALLED IN RIGID NONMETALLIC CONDUIT. IN LOCATIONS WHERE NONMETALLIC CONDUITS ARE USED, CHANGE TO HEAVY WALL METALLIC CONDUIT OF THE SAME INTERNAL DIAMETER BEFORE RISING OUT OF GROUND. PROVIDE METALLIC CONDUIT ELBOWS. a. PITCH CONDUITS A MINIMUM SLOPE OF 1:300 DOWN TOWARD MANHOLES AND HANDHOLDS AND
- BETWEEN TWO MANHOLES TO DRAIN IN BOTH DIRECTIONS. b. PROVIDE A MEANS FOR DRAINAGE, SUCH A HOLE DRILLED IN THE BOTTOM OF THE CONDUIT, AT LOW POINT OF UNDERGROUND CONDUITS. COORDINATE DRAINAGE WITH DIVISION 2.

AWAY FROM BUILDINGS AND EQUIPMENT. SLOPE DUCTS FROM A HIGH POINT IN RUNS

- 18. FEEDER CIRCUIT WIRING SHALL BE IN CONDUIT OR EMT. 19. ALL WIRING IN OUTSIDE WALLS SHALL BE IN CONDUIT OR EMT.
- 20. ALL WIRING IN MASONRY WALLS SHALL BE IN CONDUIT OR EMT.
- 21. IN GENERAL, CONDUCTORS SHALL BE THE SAME SIZE FROM THE LAST PROTECTIVE DEVICE TO THE LOAD AND SHALL HAVE AN AMPACITY THE SAME AS OR GREATER THAN THE AMPACITY OF THE PROTECTIVE DEVICE WHERE THE WIRE SIZE IS NOT SHOWN ON THE DRAWINGS. USE THE 600C AMPACITY RATING FOR WIRE SIZES NO. 14 THROUGH NO. 1. FOR 120V CIRCUITS, HOME RUNS LONGER THAN 50 FEET SHALL BE MINIMUM NO. 10 AWG, LONGER THAN 100 FEET SHALL BE MINIMUM NO. 8 AWG, AND LONGER THAN 180 FEET SHALL BE MINIMUM NO. 6 AWG.
- B. GROUNDING: THE ENTIRE ELECTRICAL SYSTEM SHALL BE PERMANENTLY AND EFFECTIVELY GROUNDED IN ACCORDANCE
- WITH CODE REQUIREMENTS. RUN A GROUNDING ELECTRODE CONDUCTOR BETWEEN THE SERVICE ENTRANCE SWITCH GROUND BUS
- AND THE METALLIC WATER PIPE SYSTEM ON THE STREET SIDE OF THE WATER METER. DRIVE GROUND RODS AT SELECTED PERIMETER LOCATIONS AS SHOWN ON THE DRAWINGS.
- 4 THE TOP OF THE GROUND RODS SHALL BE A MINIMUM OF 6" BELOW FINISHED GRADE 5. ALL PERIMETER ELECTRICAL SPLICES AND CONNECTIONS AND ALL CONNECTIONS TO GROUND RODS, BUILDING STEEL, REINFORCING RODS, ETC., SHALL BE EXOTHERMIC WELD CONNECTIONS, CALDWELD OR
- APPROVED FQUAL. CONNECTIONS TO THE WATER SERVICE SHALL BE MADE WITH AN APPROVED GROUND CLAMP.
- CONNECTIONS TO JUNCTION BOXES, EQUIPMENT FRAMES, ETC., SHALL BE BOLTED.
- CONDUIT SYSTEMS:

GROUNDING CONDUCTOR MUST BE BONDED TO ALL FIXTURES.

- a. GROUND ALL METALLIC CONDUIT SYSTEMS. b. CONDUIT SYSTEMS SHALL CONTAIN A GROUNDING CONDUCTOR SIZED PER NEC TABLE 250-122 OR AS SHOWN ON THE DRAWINGS. INCREASE CONDUIT SIZE WHERE NECESSARY TO
- ACCOMMODATE THE GROUNDING CONDUCTOR. 9. FEEDERS AND BRANCH CIRCUITS: INSTALL GREEN GROUNDING CONDUCTORS WITH ALL FEEDERS AND BRANCH CIRCUITS.
- 10. BARE COPPER GROUND CONDUCTORS SHALL BE PAINTED WITH BITUMASTIC PAINT WHERE THEY ENTER AND LEAVE CONCRETE STRUCTURES. 11. BARE COPPER GROUND CONDUCTORS SHALL BE A MINIMUM OF 30" BELOW FINISHED GRADE.

12. LIGHTING FIXTURES: CONDUITS SHALL NOT BE USED FOR GROUNDING FIXTURES. GREEN EQUIPMENT

- C. CONTINUITY OF SERVICES: ARRANGE TO EXECUTE WORK AT SUCH TIMES AND IN SUCH LOCATIONS TO PROVIDE UNINTERRUPTED SERVICE TO THE BUILDING OR ANY OF ITS SECTIONS. IF NECESSARY. TEMPORARY POWER SHALL BE INSTALLED TO PROVIDE FOR THIS CONDITION. AUTHORIZATION FOR INTERRUPTING SERVICE SHALL BE OBTAINED IN WRITING FROM THE OWNER. ANY INTERRUPTION OF NORMAL SUPPLY SHALL BE PERFORMED DURING AN OVERTIME PERIOD TO BE SCHEDULED WITH THE
- OWNER. COST FOR OVERTIME WORK SHALL BE INCLUDED IN THE BID. D. IDENTIFICATION: PROVIDE TAGS ON EACH END OF ALL PULLED WIRES GIVING LOCATION OF OTHER END. PROVIDE PHENOLIC NAMEPLATES FOR ALL PANELBOARDS, MOTOR STARTERS, DISCONNECT SWITCHES (EXCEPT SWITCHES LOCATED AT MOTORS), AND DUCT SMOKE DETECTOR REMOTE
- TEST/ALARM-INDICATING STATIONS. E. RECORD DRAWINGS: THE CONTRACTOR SHALL KEEP ON THE JOB A SET OF PRINTS SHOWING ANY CHANGES TO THE INSTALLATION. THESE SHALL BE GIVEN TO THE ENGINEER AT THE COMPLETION OF
- F. AS BUILT AND O AND M MANUALS.

ARCHITECT/ENGINEER.

- ALL REQUIRED MANUALS AND AS BUILT WILL BE FURNISHED BEFORE RETAIN AGE IS PAID.
- G TESTING AND ADJUSTING:
- THE ENTIRE INSTALLATION SHALL BE FREE FROM SHORT-CIRCUITS AND IMPROPER GROUNDS. TESTS SHALL BE MADE IN THE PRESENCE OF THE ENGINEER OR HIS REPRESENTATIVES. EACH INDIVIDUAL LIGHTING CIRCUIT SHALL BE TESTED AT THE PANEL; AND IN TESTING FOR INSULATION
- RESISTANCE TO GROUND, THE LIGHTING EQUIPMENT SHALL BE CONNECTED FOR PROPER OPERATION. IN NO CASE SHALL THE INSULATION RESISTANCE BE LESS THAN THAT REQUIRED BY THE NATIONAL ELECTRICAL CODE. FAILURES SHALL BE CORRECTED IN A MANNER SATISFACTORY TO THE
- EACH SYSTEM SHALL BE COMPLETELY TESTED AND SHALL BE ADJUSTED FOR PROPER OPERATION AS REQUIRED BY THE ENGINEER.

END OF SECTION

# GENERAL NOTES:

- 1. SEE SHEET EO.O FOR LEGEND AND GENERAL NOTES.
- 2. COORDINATE WITH ARCHITECTURAL DRAWINGS FOR EXACT STUB UP LOCATIONS.

# KEYED ELECTRICAL NOTES:

- CONDUIT STUB UP FOR PANEL "HP1". CONNECT SERVICE CONDUCTORS TO ENCLOSED 225A CIRCUIT BREAKER FOR MEANS OF DISCONNECTION.
- (2) CONDUIT STUB UP FOR PANEL "P1B". CONNECT SERVICE CONDUCTORS TO ENCLOSED 150A CIRCUIT BREAKER FOR MEANS OF DISCONNECTION.
- <3> CONDUIT STUB UP FOR PANEL "P1A". CONNECT SERVICE CONDUCTORS TO ENCLOSED 150A CIRCUIT BREAKER FOR MEANS OF
- (4) CONDUIT STUB UP FOR 150A ENCLOSED CIRCUIT BREAKER. BREAKER TO FEED SECOND FLOOR PANEL "P2A".

(5) CONDUIT STUB UP FOR 150A ENCLOSED CIRCUIT BREAKER. BREAKER

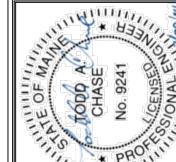
(9) CONDUIT EXITS SLAB AT THIS POINT AND SHALL BE SUPPORTED FROM

- TO FEED SECOND FLOOR PANEL "P2B". (6) CONDUIT STUB UP FOR 100A ENCLOSED CIRCUIT BREAKER. BREAKER
- $\langle 7 
  angle$  3 #2/0 AWG CU IN 2" RIGID METAL CONDUIT.

STRUCTURE ABOVE.

TO FEED SECOND FLOOR PANEL "P2C".

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angle$  3 #4/0 AWG CU IN 2-1/2" RIGID METAL CONDUIT.



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