

In case of conflicts between drawings, or specs and drawings, Contractors shall request clarifications in writing from Architect/Engineer, otherwise the more stringent requirements shall be provided.

GENERAL NOTES AND ELECTRICAL SPECIFICATIONS

Code Information:
Applicable codes include but are not limited to: City of Houston Electrical Code, National Electrical Code (2002 N.E.C.), Occupancy Classification: R

16010 Basic Electrical Requirements
Permits and Codes: Obtain and pay for all necessary permits and required inspections. Comply with all national, state and municipal laws, codes and ordinances relating to building and public safety. Provide any required temporary power and utilities for all trades and all construction trailers. Provide temporary construction lighting and power. Electrical Contractor shall include Temporary Electric: All temporary electric shall be in accordance with OSHA Construction standards 29CFR, Part 1926 and Article 305 of the National Electrical Code. Temporary lighting and power shall be provided in accordance with OSHA standards. The OSHA minimum is 5 footcandles. Included are connections to all construction trailers. The cost of this work is to be included in the base electrical bid for the project.

Drawings: Drawings are diagrammatic, confirm dimensions & locations in the field. If conflicting dimensions are shown, use larger dimensions and verify with Architect. See architectural plans and elevations for exact locations of fixtures and wall mounted devices.

Material: All materials shall be new, made in USA and U.L. listed. Material installation shall comply with NEC requirements and perform by craftsmen skilled in this particular work.

Equipment Protection: Protect equipment and work from damage during handling and installation until completion of construction.

Relation with other Trades: Cooperate with other trades as necessary to accomplish the full intent of the documents.

Access Panel: Provide access panels of doors for all devices requiring adjustment. Similarly for all junction boxes, pull boxes, etc. that are required to be accessible per Code and/or the local authority having jurisdiction. Appearance of access panels/doors shall be acceptable to Architect. Panels/doors shall be designed for the fire rating of wall or ceiling in which they are installed. All access panels shall be lockable and shall be keyed alike (some keying as panels from other divisions).

Pleniums: Plenums are crowded and not all obstacles are indicated. Allow for conduit offsets and pull boxes not indicated on drawings.

Plaster, gypsum board or other non-accessible ceilings:
Contractor shall minimize cutting and patching by installing conduit prior to ceiling/wall/partition cover-up.

Clean Up: A) Provide for isolation of work areas and daily removal of debris. B) Clean all equipment and fixture lenses. C) Replace all burned out lamps. D) Touch up with paint where required.

Submittal Data: Submittals are required but not limited to the following equipment:
Lighting Fixtures
Branch Circuit Panelboards, switches, etc.
Emergency Standby Generator System
Conduit/Fittings
Wires
Lightning Protection System

Shop Drawings: Required.

Complete Systems: All systems shall be complete and working at completion of construction.

Final Inspection & Operating Tests:
At the time designated by the Architect, the entire system shall be inspected by the Architect and the Engineer. The Contractor or his representative shall be present at this inspection.
After all systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections.
The Contractor shall provide a set of as-built drawings and mylar reproductions to the Owner/Arch. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

Guarantee: Guarantee all work and materials furnished under this contract for a period of one year from the date of acceptance by the Owner and Architect. Guarantee shall include: All labor, parts, travel/subsistence, software changes / re-programming, etc.

Record Drawings: Required.

16111 Conduit
Conduit: Shall be electrical metallic tubing (EMT) as manufactured by Allied, Triangle or Wheatland.
Indoors above grade: EMT
Outdoors above grade, stub-ups, or on roof: RGS or IMC.
Below grade: Schedule 40 or 80 PVC or RGS. Provide transition fittings from PVC Sch 40 or 80 to RGS for all above grade conduit. Underground conduit minimum size 3/4". Minimal 24" burial depth from finished grade to top of conduit. Provide detectable warning tape over entire run of service and major conduit runs.
(SEE CIVIL DRAWINGS FOR PROPOSED CONDUIT ROUTING AND PROPOSED DEPTH)

Under slab: RGS, Schedule 80 PVC.
Install ground wires where shown on the drawings. Compression or set-screw type fittings shall be used for EMT. Minimum conduit size 1/2 inch, however homerun to panel shall be minimum 3/4 inch.

Flexible conduit shall be utilized as final connections (3'-5' only) at the following equipment: motors. Utilize 1/2" flexible metallic conduit minimum and include a green ground wire. Use sealrite in wet locations such as pool equipment units, etc. Maintain minimum 12" separation from all high temperature pipes.

Project Record Documents: Accurately record actual routing of all under-slab and underground conduits; include dimensions from key building points and depth of bury.

16123 Building Wire and Cable
Wire: (Triangle, American Insulated Cable Co., or Cable) All wires must be 75°C rated or better. 60°C rated wire shall not be used. 90°C rated wire may be used but only at 75°C ampacity.

Type "NM" and "NMC" nonmetallic-sheathed cable (commonly referred to as "Romex" cable) is an approved wiring method and may be used throughout the project.

A) Minimum size #12 except controls may be #14. Use #10 conductors for 20 ampere, 120 volt branch circuits longer than 100 feet.
B) Type THHN/THWN stranded copper thermoplastic in dry locations.
C) Type THWN in wet locations (outdoor, underground, on roof...)
D) All wire shall be 98% conductivity copper, 600 volt, NO ALUMINUM WIRES.
E) Wire #10 and smaller may be solid or stranded, #8 or larger shall be stranded.
F) Communication wires (Fire Alarm, Telephone, HVAC thermostat, data etc.): Plenum rated low-smoke cable may be used in lieu of wire/conduit type installation. All plenum rated cable shall be properly supported by bridged rings, cable ties, clips etc made by Erica (caddy communication fasteners) or equal. Do not use scrap wire to wrap and support communication wires. Homemade support devices are not acceptable. Do not lay communication cable directly on top of ceiling tiles, install cables a minimum of 12" above ceiling tiles and 12" from HVAC ductwork. Provide minimum 6" separation between power conduit and communication wiring.

16130 Boxes
Outlet Boxes: Shall be galvanized steel suitable for location. Ceiling outlet boxes shall be 4" octagon. Wall outlet boxes shall be proper design to accommodate the devices required - 4 inch square with raised cover. Provide Roco, Steel City or Applinet. ALL J-BOXES / SPLICE BOXES MUST BE ACCESSIBLE.
Junction / Pull boxes: (a) for each conduit run: provide one junction/pull box for each equivalent three quarter bends (270-degree). (b) underground feeders: minimum one pull box for each 350 feet of conduit run.

16140 Wiring Devices
Wiring Devices: Furnish and install where indicated on drawings. All devices shall be Leviton "Decora" type (white color, confirm w/Architect) or approved equal unless specified otherwise by Architect. Ground fault circuit interrupter (GFCI) receptacle shall have integral LED indicator light.

All electrical boxes on opposite sides of corridor wall and firewalls must be separated by a horizontal distance of not less than 24 inches (191 U.L.C. 4304(f)).

16170 Grounding and Bonding
Grounding: All conduit work and electrical equipment shall be effectively and permanently grounded in accordance with NEC requirements. Provide green equipment grounding conductor with all power and receptacle and lighting circuits. Service grounds, section #1 of 2-SECT PNL.
FEDER SIZE 3 # 4/0 THWN, 1 # 4 G, 2 1/2" C.
FED FROM DIST PANEL "XXX", 1ST FLOOR

16195 Electrical Identification
Identifications: Label all junction and pull boxes with panels and circuit numbers. Furnish markers or paint band for each conduit longer than 6 feet, spacing 20 feet on center. Label all homerun and major conduit with home panels/switches, etc. at every 10-ft. interval if accessible and/or visible, example: Panel "X", Sw. "X", Cond Unit XXX, etc. Mark all branch conduit with circuit numbers at each surface mounted panel location. For recessed panels, mark branch conduit in ceiling plenum just above panels.
Color Code: Conductors shall be color coded as follows (follow Houston's color codes):

	120/240V
	1 Ph, 3W
Phase A	Black
Phase B	Red
Neutral	White
Ground	Green

All panels shall be identified using nameplates with 4 rows of text (letter height shall be 1/4" minimum), example:
PANEL "XX" 225 AMPS, SECTION #1 of 2-SECT PNL
120/240V, 1 PHASE, 3 WIRE
FEDER SIZE 3 # 4/0 THWN, 1 # 4 G, 2 1/2" C.
FED FROM DIST PANEL "XXX", 1ST FLOOR

Panel nameplates shall be engraved three-layer laminated plastic, white letters on black background for normal power, red letter/black background for emergency power. Secure nameplates to equipment using screws or rivets.

All switches, starters, wireways, communication cabinets etc. shall be similarly identified.

16441 Enclosed Switches, 16470 Panelboards
Panelboards: Shall be Square D, Cutler Hammer/Westinghouse, Siemens/ITE or GE. All equipment shall have copper busses or windings. Load center type panelboards are not acceptable and shall not be used. All breakers shall be bolt-on thermal magnetic type, with common trip handle for all poles, handle-ties are not acceptable. Stab-on breakers are not acceptable. Do not use tandem circuit breakers. All circuit breakers rated 100 amp or less shall be suitable for terminating 75°C wire (breakers rated for only 60°C wire is not acceptable. See 16123 - Wire). All safety switches shall be heavy duty type and suitable for terminating 75°C wire. All equipment shall be labeled, panelboards shall be labeled both on the coverplates and the interiors.
Panelboard Directories: Identify each circuit with load and locations (room names and room numbers) and indicate with typed directories. (Example: 5 duplex receptacles, Office, RM XXX).
For each panel: furnish and install one spare 3/4" conduit for every 6 spares and/or spaces in the panel. Each spare conduit shall be installed with pull string stubbed to a J-box located in accessible ceiling/plenum space. Install a minimum of one spare 3/4" conduit for every panel shown on plans, even if there are no spares/spaces in some panels.

16700 Communication Systems
Telephone, Data, Monitoring Systems: By others.

GENERAL NOTES: (Apply to All Electrical Sheets)

G1. All circuit numbers shown are for reference only. Field verify actual circuit numbers required and adjust accordingly.
Provide type-written director(ies) reflecting actual circuit numbers used, with field revised/relocated circuits clearly indicated. Director(ies) shall include date and project description, example: 2011 MMHRA-701 SWF

G2. Each circuit is shown with an individual homerun. E.C. may elect to combine two or more circuits in one common conduit and with common neutral where allowed (circuits with high content of harmonic currents may not use common neutral, example: circuits with non-linear electronic power supplies such as computers, copiers, printers, etc.).
Note: Ampacities of conductors shall be reduced if more than three current carrying conductors are installed in a raceway. See N.E.C. Article 310-15.8(a).
Notes to ampacity tables of 0 to 2000 volts. Conductors shall be derated if 4 or more wires are installed in one conduit (see related note "G3" on temperature limitation of conductor ampacity). Typical examples for 20-amp circuits are shown below.

No. of current carrying conductors if necessary	% of value in tables as adjusted for temperature	Wire size, 4 or more wire in one conduit 60°C wire (e.g.: THW)	Wire size, 4 or more wire in one conduit 75°C wire (e.g.: THWN)	Wire size, 4 or more wire in one conduit 90°C wire (e.g.: THHN)
4 thru 6	80 %	# 12	# 12	# 12
7 thru 9	70 %	# 10	# 10	# 12
10 thru 20	50 %	# 8	# 8	# 10
21 thru 30	45 %	# 6	# 8	# 8
31 thru 40	40 %	# 4	# 8	# 8
41 and above	35 %	# 4	# 8	# 8

G3. Temperature limitations on ampacity of conductor:
The ampacity of a conductor shall be selected based on the National Electrical Code Articles 310-15 and 110-14-(c)-(1),(2),(3). The temperature limitations noted in 110-14-(c)-(1),(2),(3) may be paraphrased as follows:

(A) Circuits rated 100 amp or less:
Use 60°C rated conductors only, 75°C and 90°C conductor may be used but only at 60°C ampacity.

Exceptions: Higher temperature cable are allowed provided the equipment is listed and identified for use with the higher rated conductors.
(B) Circuits rated more than 100 amp or conductor larger than 1" Use 75°C rated conductors only, 90°C conductor may be used but only at 75°C ampacity.

Exceptions: Higher temperature cable are allowed provided the equipment is listed and identified for use with the higher rated conductors.

G4. Wires oversized to alleviate voltage drop: Where oversized wires are used to alleviate voltage drop, Contractor to provide reducer lugs and/or J-boxes as required to terminate wires in equipment.

G5. All conduit and wire must be concealed from view. Exposed conduit and wire are not acceptable, exceptions are Mechanical/Electrical Rooms.

G6. All electrical and communication devices (light switches, receptacles, telephone, data, etc.) shall be recessed mounted unless noted otherwise. Field verify receptacle mounting requirements with Owner/Arch., mount all duplex receptacles with the "L" ground terminal on bottom, unless noted otherwise or as required by Owner/Arch. Neutral terminal shall be on top for horizontally mounted receptacles.

G7. Equipment layout is based on Square D and/or Siemens equipment by other manufacturers such as GE may have larger dimensions. It is the responsibility of the electrical contractor to provide equipment with similar dimensions that would fit in the space noted.

G8. Verify location of all outlets (power & communication) with Owner/Arch prior to rough-in. Owner reserves the right to move any outlets 5 feet in any direction prior to rough-in. All receptacles within 6 feet of any wet area (example: sink, dishwasher, etc...) shall have ground fault circuit protection, whether specifically indicated on drawings or not.

Mounting height of all outlets (receptacles, switches, telephone, data, etc.) in areas with countertop shall be verified with Arch/Owner. Generally all outlets are to be mounted above countertop except outlets for disposers, undercounter dishwasher, undercounter refrigerators, etc. Refer to Arch interior elevations.

All weatherproof/wet location and/or outdoor receptacles shall have "weatherproof-in-use" covers (NEC Article 410-57(b)). Provide Roco Bell Ropylite II covers or equal.

G9. Switches/starters for mesh and other equipment: Location of disconnect switches, starters, control stations, etc. are shown diagrammatically on the drawings. E.C. shall install such devices in compliance with Code required clearance requirements. All such devices shall be accessible after equipment are in place and satisfy code clearance requirements. Remove and re-install devices that are inaccessible or with inadequate code clearance. Coordinate installation w/HVAC.

G10. HVAC Equipment: Overcurrent devices, disconnect switches, conduit/wire are selected based on equipment shown on Mechanical drawings. Field verify ratings of eqpt supplied by Mech Contractor as required to match actual eqpt supplied by Mech Contractor.

G11. Estimated Loads: Information and data on specialty equipment may not be available during the design process. Some loads are necessarily estimated. Such estimated loads are indicated as (EST.) on plans, riser diagrams and/or panel schedules. Contractor shall bid the project using the estimated feeder/breaker/switches shown on drawings. However, the Contractor is responsible for confirmation and verification of all such estimated loads with the appropriate vendors/suppliers. All shop drawings submitted by the Contractor shall include certification that the Contractor has confirmed/verified any estimated loads shown on the drawings. Contractor will not be due any additional compensation for his failure to verify the estimated loads shown on drawings. provide credit to the Owner if actual loads are smaller than estimated loads, credit shall be given for size reduction of feeder/breaker/switches.

Example of equipment loads that are typically estimated: elevator machinery ...

G12. Exhaust Fans: Where exhaust fans are indicated as interlocked with HVAC equipment, E.C. shall provide all required relays, conduit/control wires, etc. as required for a complete and operating system. Coordinate interlock requirements with HVAC contractor.

G13. Provide house keeping concrete pads (minimum 4" high) for all outdoor/outdoor floor or ground mounted electrical equipment including switches, transformers, switchboards, M.C.C., transfer switches etc. Provide all required and necessary galvanized unistrut support for all indoor/outdoor electrical equipment.

ELECTRICAL LEGEND

ALL SYMBOLS SHOWN ARE NOT NECESSARILY USED IN THIS PROJECT

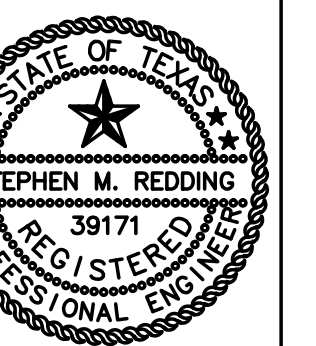
- 1' x 4' FLUORESCENT LIGHT FIXTURE. LETTER INDICATES TYPE.
- FLUORESCENT (OR) INCANDESCENT DOWN LIGHT FIXTURE. LETTER INDICATES TYPE.
- EXIT LIGHT. PROVIDE DIRECTIONAL CHEVRON(S) ARROW(S) AS INDICATED ON PLANS. CONNECT INTEGRAL BATTERY PACK TO UN-SWITCHED POWMER LEADS.
- THREE(3) WAY SWITCH
- FOUR(4) WAY SWITCH
- KEYED SWITCH
- SWITCH WITH PILOT LIGHT
- MANUAL MOTOR STARTER WITH PROPER THERMAL ELEMENT INSTALLED.
- SWITCH, THREE-WAY MOMENTARY CONTACT TOGGLE TYPE WITH CENTER NEUTRAL POSITION. SIMILAR TO ASCO # 173A2.
- BI-LEVEL OR ALTERNATE SWITCHING.
SWITCH "a" CONTROL INBOARD LAMPS OR FIXTURES LABELLED "a".
SWITCH "b" CONTROL OUTBOARD LAMPS OR FIXTURES LABELLED "b".
- 3-WAY BI-LEVEL OR ALTERNATE SWITCHING, SIMILAR TO ABOVE.
- DIMMER SWITCH, 600 WATT TYPICAL UNLESS NOTED OTHERWISE. PROVIDE THE FOLLOWING UNLESS NOTED OTHERWISE ON THE DRAWINGS:
LUTRON # NOVA - 1 SERIES WITH PRESET
FOR 600 WATT - #NT-600P, FOR 1000 WATT - #NT-1000P,
FOR 1500 WATT - #NT-1500P, FOR 2000 WATT - #NT-2000P.
- DUPLEX RECEPTACLE, 20AMP, 125VOLT, 2POLE, 3WIRE, GROUNDING TYPE, NEMA 5-20R
- DOUBLE (QUAD) DUPLEX RECEPTACLE WITH COMMON COVER PLATE. SIMILAR TO DUPLEX RECEPTACLE.
- DUPLEX RECEPTACLE, ISOLATED GROUND TYPE
20AMP, 125VOLT, 2POLE, 3WIRE, NEMA 5-20R, SIMILAR TO LEVITON #5362-IG.
- DEDICATED DUPLEX RECEPTACLE, PROVIDE GRAY COLOR (CONFIRM W/ARCHITECT) RECEPTACLE AND COVER PLATE, WITH INTENDED USAGES OF RECEPTACLES ENGRAVED ON COVERPLATE (E.G. "COPIER").
- GROUND FAULT INTERRUPTOR (GFI) DUPLEX RECEPTACLE. SIMILAR TO DUPLEX RECEPTACLE ABOVE.
- WEATHERPROOF (WP) DUPLEX RECEPTACLE. SIMILAR TO DUPLEX RECEPTACLE ABOVE.
- SWITCHED DUPLEX RECEPTACLE. SIMILAR TO DUPLEX RECEPTACLE ABOVE. SWITCHED SIDE SHALL BE CONNECTED TO LIGHTING CONTROLS
- SINGLE RECEPTACLE. TYPE AS INDICATED ON DRAWINGS.
- 220V RECEPTACLE. TYPE AS INDICATED ON DRAWINGS.
- FLUSH FLOOR DUPLEX RECEPTACLE (NEMA 5-20R). PROVIDE WALKER FLOOR BOXES WITH BRASS COVER PLATE AND CARPET FLANGE AS REQUIRED.
- TELEPHONE OUTLET. PROVIDE BACK BOX/COVER PLATE. INSTALL 3/4" C. WITH BUSHING AND PULL STRING, STUBBED TO ACCESSIBLE CEILING.
- DATA OUTLET. PROVIDE BACK BOX/COVER PLATE. INSTALL 3/4" C. WITH BUSHING AND PULL STRING, STUBBED TO ACCESSIBLE CEILING.
- COMBINATION TELEPHONE/DATA OUTLET. PROVIDE BACK BOX/COVER PLATE. INSTALL 3/4" C. WITH BUSHING AND PULL STRING, STUBBED TO ACCESSIBLE CEILING.
- FLUSH FLOOR TELEPHONE / DATA OUTLETS. PROVIDE WALKER FLOOR BOXES WITH BRASS COVER PLATE AND CARPET FLANGE AS REQUIRED.
- DEVICES MOUNTED ABOVE COUNTER (VERIFY W/ARCHITECT FOR EXACT HEIGHT). TYPICAL FOR ALL DEVICE SHOWN WITH A SOLID DOT.
- JUNCTION BOX
- DISCONNECT SWITCH. ALL SWITCHES SHALL BE HEAVY DUTY TYPE (E.G. 30A/3P/600NF/NEMA 1)
- COMBINATION DISCONNECT SWITCH AND MAGNETIC MOTOR STARTER. 30AMP SIZE 1. MINIMUM TYPICAL UNLESS NOTED OTHERWISE. PROVIDE CONTROL POWER TRANSFORMER, 2 N.O. AND 2 N.C. CONTACTS, HAND-OFF-AUTOMATIC SWITCH, RED PILOT LIGHTS ("RUN" LIGHT). PROVIDE OVERLOAD RELAYS MATCHING FLA OF EQUIPMENT.
- ELECTRIC MOTOR
- DISTRIBUTION PANEL, MOTOR CONTROL OR SWITCHBOARD
- ELECTRICAL PANELBOARDS.
- EQUIPMENT POINT OF CONNECTION BY ELECTRICAL CONTRACTOR
- LIGHTING KEYPAD: SEE ILLUMINATION DESIGN FOR TYPE AND MODEL NUMBER
- CONDUIT RUN CONCEALED IN WALL OR CEILING
- CONDUIT RUN CONCEALED IN FLOOR
- CONDUIT RUN BELOW GRADE
- HOMERUN TO ELECTRICAL PANELBOARDS
- PARTIAL HOMERUN TO ELECTRICAL PANELBOARDS.

LEGEND NOTES:

1. THE WORD "PROVIDE" AS USED IN THESE DRAWINGS SHALL MEAN "MATERIALS AND LABOR FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR".
 2. MOUNTING HEIGHT OF ALL LIGHT SWITCHES, DIMMERS, RECEPTACLES, TELEPHONE, DATA AND SIGNAL OUTLETS SHALL BE IN ACCORDANCE WITH THE "AMERICAN WITH DISABILITIES ACT" - LIGHT SWITCHES, DIMMERS, ETC. (+42") RECEPTACLES, TELEPHONE, DATA, ETC. (+18")
- ALL MOUNTING HEIGHTS ARE MEASURED FROM FINISHED FLOOR TO CENTER OF DEVICE. MOUNTING HEIGHTS SHOWN ON THE ARCHITECT DRAWINGS AND SPECIFICATIONS TAKE PRECEDENCE. VERIFY EXACT MOUNTING HEIGHT REQUIRED WITH ARCHITECT AND INSTALL ACCORDINGLY.

AIR HANDLING UNIT REPLACEMENT PROJECT
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DATE:
01/10/2011

PROJECT #
10467.01

SHEET #

E-1.00

ISSUED FOR PRICING