2. PRODUCT STANDARD:

2.1 Standard must be written around G&W rotary puffer (RP style) vacuum interrupter.

2.2 For use with underground feeders, height of switch must be specified approximately 18” higher than standard in order to allow for proper bending radius of cables.

2.3 Specify dead front elbow type connectors.

2.4 Specify enclosure for vacuum interrupter where installed other than in electrical vaults. Where installed in electrical vaults, enclosure for vacuum interrupter is not required.
1. PRODUCT STANDARD:

1.1 All wiring (including 10 AWG and smaller) shall be stranded copper.

1.2 Branch circuit wiring shall be #12 AWG, minimum.

1.3 Control circuit wiring shall be #14 AWG, minimum.

1.4 Insulation type indoors shall be THWN/THHN type. Insulation type outdoors shall be THWN or XHHW type.

1.5 In general, MC cable will not be allowed. On a case-by-case basis, stranded conductor type MC cable may be allowed in existing walls and for fixture whips. Coordinate use of MC cable with the Rice University’s Project Manager.

1.6 Type AC cable (trade name BX) will not be allowed.
1. DESIGN STANDARD:

1.1 In general, cable tray is used for Data cabling, is not used for Power cabling.

1.2 In general, cable tray is not used outdoors.

1.3 Contractor shall provide submittal for proposed cable tray.

2. PRODUCT STANDARD:

2.1 Provide center-spine type tray (center hung) for data/communications cabling where cable tray is installed.

2.2 Exact cable tray features, the size, the load rating, the support spans, etc. should be determined per application, but should be discussed with the Rice University’s Project Manager.

2.3 Material for cable tray shall be identified as Aluminum.

3. PERFORMANCE STANDARD:

3.1 The exact grounding method, requirements for custom labeling of the tray, fire barrier method for the tray, mounting of outlets to the tray, etc. should be determined per the application.

3.2 For exposed cable tray, coordinate color of tray with Architect.
1. DESIGN STANDARD:

In general, buildings on Rice University main campus are served from the Rice University power distribution system. Service to each building is from Rice University Medium-Voltage cabling distribution system. For each new building added to the main campus, a preliminary load analysis will be required and discussion with the Rice University Project Manager will be required to determine the proper medium-voltage circuit to serve as the power source for the new building.
1. **DESIGN STANDARD:**

1.1 The design professional shall include requirements in the Contract Documents to require specific qualifications of the contractor.

   1.1.1 Installing contractor to be licensed by the State Fire Marshal.

   1.1.2 Contractor to have State Fire Marshall licensed technician on-staff.

   1.1.3 Contractor to have at least (2) NICET Level II planning superintendents for supervision of system design.

   1.1.4 Contractor to have 10 year experience record.

   1.1.5 Contractor to have minimum of (5) networked systems previously installed.

1.2 The design professional shall include requirements for submittals and shop drawings:

   1.2.1 Line by line specification review.

   1.2.2 Complete bill of material.

   1.2.3 Factory data sheets for proposed equipment

   1.2.4 Complete floor plan drawings.

   1.2.5 Riser diagram including conduit sizes.

   1.2.6 Control panel wiring

   1.2.7 Power supply and battery calculations

   1.2.8 Software programming matrix

   1.2.9 Programming labels.

   1.2.10 Pre-Inspection Report (re: paragraph 3.2.1).

1.3 The design is required to be based on extension of the existing campus-wide fire alarm system network. Addressable-only (non-networked) systems will not be acceptable.

1.4 Discuss with Rice University’s Project manager the requirement for a complete conduit raceway system. Complete conduit system is required for new construction, may be cost prohibitive for retro-fit projects.
1.4.1 If conduit is provided, minimum size is ¾”.

1.4.2 If open wiring (fire alarm cable without conduit) is allowed, cabling is required to be routed parallel and perpendicular to building lines, is required to be supported clear of access panels, equipment maintenance spaces, etc.

1.4.3 Conduit will always be required in the following locations:

   1.4.3.1 Inaccessible locations
   1.4.3.2 Inside concealed walls
   1.4.3.3 All mechanical rooms
   1.4.3.4 Other areas where exposed and subject to damage
   1.4.3.5 Vertical wiring and main trunk/riser wiring (complete system)

1.5 Attached Document: Refer to Addendum “Fire Alarm System and Network Specifications” for additional information.

2. PRODUCT STANDARD:

2.1 Network Requirements.

2.1.1 Manufacturer of existing campus-wide system is Notifier. New equipment to be Notifier and to be able to communicate on the Notifier network.

2.1.2 Network communications protocol to utilize non-proprietary LAN technology incorporated token-passing feature. Systems utilizing collision recovery software will be unacceptable.

2.1.3 Points added to the Network shall also be programmed on the existing Notifier network terminal located at the Rice University Campus Police Station.

2.1.4 Existing network has the capacity of at least 100 nodes and provides at least 200,000 points of detection.

2.1.5 Network communications path shall be style 7.

2.1.6 All fire alarm control panel networking firmware and IC chips shall be compatible with existing firmware version.

2.1.7 Existing Network Reporting Terminal (NRT) shall remain and be programmed to accept additional panels (nodes).

2.2 Fire Alarm System Requirements:

2.2.1 Alarm Verification to be field programmed for each respective detector.
2.2.2 System shall have capability to employ analog “intelligent” smoke detectors and addressable interface devices.

2.2.3 System shall include a special non-lock “walk test” mode.

2.2.4 System shall include a special automatic detector test feature permitting reading and adjustment of the sensitivity of all intelligent detectors from the fire alarm control panel.

2.2.5 System shall be able to generate a print of system status reports.

2.2.6 System shall be 100” field programmable locally or across the network without replacement of memory IC’s. Factory programming/reprogramming or replacement of IC memory chips will not be acceptable.

2.2.7 System shall be able to store a minimum of 400 system events in order of occurrence. Systems not employing event history memory storage will be required to furnish a printer/recorder for recording system events.

2.3 Fire Alarm System Components:

2.3.1 Smoke detectors to be the Intelligent Analog type to provided with automatic sensitivity “drift” compensation and “maintenance alert” features.

2.3.2 Intelligent thermal detectors to utilize dual electronic thermostats and to be capable of providing data to the fire alarm panel representing the analog temperature level.

2.3.3 Manual pull stations shall be addressable type.

2.3.4 LDC annunciators to be Notifier LCD-80 type, to operate on 24V DC power and function during system power failure via standby batteries. Annunciator to be flush mounted wherever possible.

2.3.5 Electronic audio-visual appliances shall provide two different field selectable tones. Electromechanical devices will not be acceptable.

2.3.6 Electronic audible signaling appliances shall provide two different field selectable tones. Electromechanical devices shall not be acceptable.

2.3.7 Electronic mini-sounder shall produce a minimum output of 82 dB at 10 feet.

2.3.8 Wire shall be UL. Listed FPL for limited energy and fire alarm applications. Wire for signaling line circuits (SLC) to be twisted shielded, low capacitance type.
2.3.9 Fiber to be multi-mode, dual window 62.5/125 15dB loss maximum, 10,000’ maximum.

3. PERFORMANCE STANDARD:

3.1 No power line wiring or any other wiring shall be run in the same conduit as fire alarm wiring.

3.2 Tests and Reports:

3.2.1 Pre-Inspection Report. Installing contractor to prepare a pre-inspection report verifying proper alpha-numeric labeling and device function.

3.2.2 Factory trained, state licensed manufacturer’s representative to perform the final fire alarm control panel connections and shall supervise testing of the system.

3.2.3 Installing contractor shall functionally test each and every device in the entire system. Testing to be performed by a licensed fire alarm superintendent.

3.2.4 Installing contractor shall provide a complete written report on the functional test of the system.

3.3 Installing contractor to make available to the owner a service to provide continuous system maintenance.
1. DESIGN STANDARDS:

1.1 Coordination with Rice University Building Design Standards Division 1: Design professional must coordinate general contract conditions with Rice University Building Design Standards Division 1. Division 1 requirements may include:

1.1.1 Campus Master Plan Maintenance

1.1.2 Existing Condition Documentation
   1.1.2.1 Campus Underground Utilities
   1.1.2.2 Utility Company Coordination (where required)
   1.1.2.3 Campus Utilities Tie-in and New Work Record Drawings

1.1.3 Work Sequence. Include a required work sequence when appropriate. Allow contractor to submit an alternate work sequence for approval.

1.1.4 Contractor’s Use of Premises

1.1.5 Allowances

1.1.6 Unit Prices. Include on bid form when appropriate

1.1.7 Alternates (Additives).

1.1.8 Field Engineering. Requirements for field engineering should be kept to a minimum.

1.1.9 Remodeling Procedures

1.1.10 General Contractor’s Requirements

1.1.11 Demonstration and Training. Demonstration and training should be included for new or specialized equipment.

1.1.12 Coordination Drawings. For complex projects, furnish the electrical layer for a combined trades coordination ceiling plenum drawing.

1.2 Coordination with Architect: The design professional should coordinate certain project requirements that may be identified in the Architectural Division 1 specifications. If not identified in Architectural Division 1 specifications, these project requirements should be discussed with the Architect prior to formulation of the Division 16 General Conditions. Project requirements that require coordination with the Architect include:

1.2.1 Submittal Review Process

1.2.2 Submittal and Record Drawings Electronic File Format
1.2.3 Testing and Commissioning

1.2.4 Owner’s Instructions

1.2.5 Project Close-out Requirements

2. PRODUCT STANDARDS:

2.1 Access Doors: Design professional to coordinate with Architect for access door types and criteria for access door locations

2.2 Rice University Standard is tunnels for new buildings. Discuss any proposed extension of the tunnel system with Rice University Project Manager.

3. PERFORMANCE STANDARDS:

3.1 The term “must”, will be used on non-negotiable criteria. For criteria identified as “should” or “is preferred”, system designer can propose alternatives.

3.2 The following submissions should be provided by the design professional at the Design Development Construction Document Phases.

3.2.1 Building electrical demand must be defined before the existing Campus electrical distribution system capacity can be evaluated by Rice University.

3.2.2 A detailed description of the proposed load, including a load analysis of connected load as well as the applied National Electrical Code diversity factors will need to be furnished to Rice University.

3.2.3 Where the load analysis for the new building or new portion of the existing building relies in part on a determination of the existing load (e.g. National Electric Code, 220.35, Optional Calculations for Determining Existing Loads), and the 1-year maximum demand data is not available, the maximum demand load (average power demand over a 15 minute period) must be continuously recorded over a minimum 30-day period, as required by National Electric Code 220.35, exception.

3.2.4 Schematic drawings of electrical connection points for the proposed building to the Campus electrical distribution system will be required.

3.3 Coordination Drawings: The design professional must require coordination drawings for major conduit runs and any busway runs. The design professional should require coordination drawings for any unusual installation or any installation that will require a close coordination of additional trades in order for the proposed equipment to properly fit, to be properly located (per Architectural requirements) and to provide the required
NEC working spaces for the division 16 contractor and the required serviceability clearances required for the division 15 contractor(s). Discuss with Rice University project manager any additional items that may be required to be shown on the coordination drawings.

3.4 Three copies of Owning and Operating Manuals in ring binders should be delivered to the Rice University’s Project Manager. They must include:

3.4.1 Required Test Reports

3.4.1 Operating and Maintenance Manuals

3.4.2 Approved shop drawings for all items of equipment requiring shop drawings.

3.4.3 Warranties

3.4.4 Equipment List with vendor’s addresses and telephone numbers and identification code.

3.5 The design and implementation of the equipment locations must be arranged such that equipment is serviceable while all portions of equipment are energized. The design professional must detail equipment working spaces such that the maintenance personnel are not required to do any of the following while servicing the equipment:

3.5.1 De-energize equipment item(s) to be serviced.

3.5.2 De-energize any equipment that may be facing the equipment to be serviced or provide any temporary ungrounded surfaces on the far side of the working space in front of the equipment.

3.5.3 Establish written procedures in order to comply with NEC 110.26 clearance requirements.

3.5.4 Work must be in conformance with NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

3.6 Removal of Existing Equipment. Rice University may wish to retain certain existing items of equipment that are to be removed during remodeling of buildings on the campus. For remodeling type projects, the design professional shall discuss with the Rice University’s Project Manager regarding right of first refusal for removed items. If Rice University’s Project Manager determines that Rice University wants to retain existing equipment items, the design profession shall include in the contract a reference that Rice University retains the right of first refusal for removed items. If Rice University determines that they do not wish to retain these items for their use, it is the intention of Rice University for the Contractor to remove these items of equipment.

3.7 Factory Witness Testing: Rice University may require attendance of factory witness
testing for certain large equipment items such as Generators or UPS systems. Coordinate factory witness testing requirements with Rice University Project Manager.

3.8 Job-Site Acceptance Testing: Rice University may require attendance of job-site acceptance testing for certain large equipment items such as Generators or UPS systems. Coordinate job-site witness testing requirements with Rice University Project Manager.
1. **DESIGN STANDARD:**

   1.1 Fuel tank to be sized for 24 hours of operation at full load.

   1.2 Fuel tank to be UL 2085 type.

   1.3 Discuss location of generator set (interior, exterior, exact location at building exterior) with Rice University Project Manager.

2. **PRODUCT STANDARD:**

   2.1 Generator set motor to be Diesel type, not spark ignited.

   2.2 Where generator set is located at building exterior, specify a quiet (sound attenuator) type enclosure. Silencer (muffler) to be located inside of the enclosure.
1. DESIGN STANDARD:

1.1 International Energy Conservation Code (IECC) calculations are to be submitted to Rice University along with 100% review drawings.

1.2 Parking Lot: Illuminance of parking lot to be per Illumination Engineering Society (IES) handbook, latest edition.

1.3 Street Lights: In general, use 60 ft to 90 ft spacing for street lights.

1.4 Walkway Lights: Spacing of walkway lighting to be designed in order to provide illuminance values per IES handbook.

1.5 Code Blue Emergency Call Stations. In general, where exterior walkway lighting is required, a Code Blue emergency call station will also be required. Location of Code Blue emergency call stations to be determined by Rice University Campus Police. Discuss requirements for Code Blue emergency call stations with Rice University Project Manager.

1.6 Exterior Lighting, Not Used: As a Rice University policy, ground mounted building facade lighting and tree mounted lighting is not used.

1.7 Exterior Pole Foundations: Reference the appropriate Rice University standard pole base structural drawings. Rice University standard drawings are based on existing Walter P. Moore structural drawings. Coordinate pole base structural detail references with Rice University Project Manager.

2. PRODUCT STANDARD:

2.1 In general, interior lighting fixtures are to be Specification Grade, by major lighting fixture manufacturer

2.2 Where acrylic lenses are specified, minimum lens thickness to be 0.125.

2.3 Electronic ballasts to be specified for interior fluorescent lighting fixtures. Magnetic ballasts will not be allowed.

2.4 Electronic fluorescent ballasts shall have at least a 5 year warranty.

2.5 Lamp Color Temperature: Rice University prefers either 3500K or 4100K lamps for fluorescent fixtures at building interiors. A single lamp color temperature shall be used for all interior fluorescent fixtures throughout the project. Coordinate exact lamp color temperature with Architect and Rice University Project Manager prior to lamp selection.
2.6 Fluorescent Lamp Type: Typical fluorescent fixture to utilize T8 type lamps.

2.7 Exit signs to be Light Emitting Diode (LED) type. Color of LED’s may be red or green.

2.8 Football Stadium Parking Lot: Standard fixture for Stadium parking lot is twin Widelite SLS800S square Supra-Lyte with two 400W HPS lamps per luminaire, 40 ft nominal mounting height.

2.9 Parking Lot (other than Football Stadium): Standard fixture for non-Stadium parking lots is Gardco Form 10, arm mount with mast arm fitter. Standard lamp is HPS type, 70 -400 watts; height of pole to be proportional to lamp watts (but not greater than 40 ft). Poles for parking lots to be Valmont type DS330 straight square steel poles with MS401 bracket arm or equal.

2.10 Street Lights: Decorative street lighting to be custom pole and luminaire by Antique Street Lamps, Inc., Austin Texas. Refer to Antique Street Lamps, Inc Drawing L1785. Rice University stocks a maintenance supply of 120V ballasts and prefers use of 120V ballast for all new Street Lights.

2.11 Walkway Lights: Walkway lighting to be Hadco Old Boston, Catalog Number V092HR5NG150SE with 1/3 frosted globe. Pole to be Hadco P1400-10H pole. Note that the Hadco V092 product has replaced the Hadco V091 product.

2.12 Circuitry for exterior lighting to be #6 AWG in 1”C.

2.13 Control of exterior lighting to be based on a master photocell sending a signal to a controller, with “ON/OFF/AUTO” control at the controller (Maintenance, Override off, Automatic photocell operation). Photocell control at individual lighting fixtures will not be allowed.

2.14 In general, exterior lighting is to be metered (sub-metered). Metering equipment to be similar to E-MON D-MON type meter from E-MON, L.P (a Hunt Power Company). Discuss exterior lighting metering with Rice University Project Manager.

2.15 Code Blue Emergency Call Stations. In general, where exterior walkway lighting is required, a Code Blue emergency call station will also be required. Location of Code Blue emergency call stations to be determined by Rice University Campus Police. Discuss requirements for Code Blue emergency call stations with Rice University Project Manager. Code Blue emergency call station to be Code Blue Cat. No. Z-40.

3. INSTALLATION STANDARD:

3.1 Where exterior lighting is being designed (parking lot lighting, street lighting, walkway lighting), provide a stub-out from the appropriate pole bases for future extension and provide spare capacity in circuitry for similar additional future lighting fixtures. Discuss appropriate pole bases for stub-outs with Rice University Project Manager.
1. DESIGN STANDARD:
   1.1 Lightning protection will be required for all buildings.
   1.2 Coordinate the design of the lightning protection system downleads with the Architect. Drawings must indicate details for lightning protection system downleads and roof penetrations.

2. PRODUCT STANDARD:
   2.1 Lightning protection system must result in a system that can obtain a UL Master Label.
1. DESIGN STANDARD:

   1.1 Standard for Rice University to be written around Okonite EPR shielded copper cable. Southwire, Kerite and other known domestic manufacturers are acceptable.

2. PRODUCT STANDARD:

   2.1 Conductor material to be Copper. Aluminum conductor will not be allowed.

   2.2 In general, 133% insulation will be required. Cable type is to be single conductor.

   2.3 In general, certified factory testing for cables will be required, except testing may not be required for small quantities of cabling. The quantity of cabling that will require factory testing should be coordinated with Rice University’s Project Manager.

   2.4 Cable to be installed in concrete-encased duct or in Aluminum conduit in tunnel system. Cable not to be direct bury type.

3. PERFORMANCE STANDARD:

   3.1 Installation in manholes shall not encroach upon access into the manhole. Final installation of cables inside of the manholes must allow free access of personnel into the manholes.

   3.2 Cable terminations and splices shall be performed by a qualified installer approved by Rice University. Dacon is one such approved installer.

   3.3 Testing of the final cable installation will be required. Testing company shall be approved by Rice University.
1. DESIGN STANDARD:

1.1 Testing criteria per the IEEE Red Book and Westinghouse Transformer Tests. Discuss exact testing procedure with Rice University’s Project Manager to further refine required testing procedure. Test results for “essentially identical” units will be acceptable where this is the normal industry practice.

1.2 Coordinate with Rice University’s Project Manager to determine if transformer(s) are to be installed indoor or outdoor.

2. PRODUCT STANDARD:

2.1 Windings for transformer to be Copper.

2.2 Pad mount transformers shall be equipped with load-break switch and fuses on the primary (medium voltage) side.

2.3 Pad mount transformers shall be equipped with bushings for dead front elbow terminations.

2.4 Dry-type transformers located in buildings to be 115 degree temperature rise type.

2.5 Tests for oil-filled transformers (outdoor transformers) to include:

2.5.1 Turns ratio test at all tap positions

2.5.2 Exciting current and no-load losses

2.5.3 Resistance measurement

2.5.4 Load losses

2.5.5 Impedance

2.5.6 Dielectric absorption

2.5.7 Insulation resistance and insulation power factor (transformers 1000 kVA and larger)

2.6 Tests for dry-type transformers (indoor only) to include:

2.6.1 Insulation resistance

2.6.2 Dielectric absorption
2.6.3  Turns ratio test at all tap positions

2.6.4  Winding resistance
2. PRODUCT STANDARD:

2.1 Each Power Distribution Unit shall be UL listed as a complete system under UL 1950 Standard for Information System Technology Equipment. PDU’s shall comply with the latest applicable FCC EMI emission limits for Class A computing devices.

2.2 Output Capacity designed for 150 KVA.

2.3 Audible noise level of each power distribution unit shall be less than the ANSI C89 standard for transformers.

2.4 Manufacturer of the PDU shall furnish an instruction manual for each PDU with installation, start-up, operation and maintenance instructions, wiring diagrams, drawings of major components and a list of recommended spare parts.

2.5 Manufacturer warranty shall be one-year for material and workmanship for 12 months after initial start-up or 18 months after shipping date.

2.6 PDU to be equipped with a microprocessor based power monitoring system. Monitored parameters and alarms to be displayed on the monitor panel and available for communication to a central monitoring system. Voltage and current to be measured using true RMS meter.

2.6.1 Input and output voltages (L-L, all three phases).
2.6.2 Output voltages (L-L, L-N, all three phases)
2.6.3 Total Harmonic Distortion for all three phases
2.6.4 Output current and Neutral current
2.6.5 Unit Ground Current
2.6.6 Output Frequency
2.6.7 Output kVA and kW
2.6.8 Output Power Factor
2.6.9 Output kWh
2.6.10 Percent Load

2.7 Acceptable manufacturers are APC, Liebert and PDI.

3. PERFORMANCE STANDARDS:

3.1 Preventative maintenance and repair services to be by factory-trained technicians available in the Houston area.
1. DESIGN STANDARD:

1.1 A short circuit fault current study and a coordination study will be required for new facilities and major electrical renovation work. The short circuit study and the coordination study will be required as part of the submittal process and equipment will not be approved without the coordination study.

1.2 Flash protection warning labeling (arc flash hazard labeling) will be required for all equipment identified by NEC 110.16. Flash thermal energy calculations will need to be provided to Rice University.

1.3 In general, Short Circuit Current Available (SCCA) rating of equipment to be fully rated (not series rated). Where SCCA Series Rating of equipment is being considered, discuss reasons with Rice University Project Manager.

1.4 Ground Fault Protection: Rice University requires coordination of equipment ground fault protection between a switchboard main device and feeder devices in that switchboard. Where ground fault protection is designed for the main device, design coordinated ground fault protection on the feeder devices.

2. PRODUCT STANDARD:

2.1 Rice University has standardized on a single manufacturer for Distribution Panelboards. Distribution Panelboards to be Square D I-Line (no substitutions).

2.2 Rice University has a preference for using Square D equipment for lighting class panelboards. Alternate lighting class panelboard manufacturers to be discussed with Rice University Project Manager.

2.3 Bussing for all power distribution equipment (switchboards, distribution panelboards, lighting class panelboards, motor control centers) to be Copper. Aluminum will not be allowed.

2.4 Lighting Panelboards to be bolt-on branch circuit breaker type construction. Plug-in or stab-on type breakers will not be allowed.

2.5 Metering, existing: Retain existing kWh meter, including pulser, unless the meter is to be replaced with a power meter with KY pulse output for Kilowatts.

2.6 Metering, new: Design for Square D Model 820 or equal, when replacing main service equipment or designing new main service equipment. Meter must have KY pulse output and be capable of storing peak demand.
3. PERFORMANCE STANDARDS:

3.1 Recessed Panelboards: Where a panelboard is installed recessed, install at least three \( \frac{3}{4} \)" empty conduits stubbed out of panelboard to nearest accessible ceiling cavity.
1. **DESIGN STANDARD:**
   
   1.1 For handful of circuits, the building’s BAS system will control lighting relays directly. For large systems, use contactors and/or relay systems.
   
   1.2 Small spaces with no preset control to be wallbox type dimmer. Small spaces with preset controls to be wallbox type product (not a central dimming system).
   
   1.3 Rice University has not yet standardized on a central control system for building interior lighting.
   
   1.4 Split bus type lighting control systems are not used at Rice University and will not be allowed.

2. **PRODUCT STANDARD:**

   2.1 Small space dimming control to be Lutron Nova T* type or equivalent.

   2.2 Small space dimming control with multiple dimming zones and preset scenes to be Lutron Grafik Eye or equal.
1. **DESIGN STANDARD:**

   1.1 The design professional shall include a requirement in the Contract Documents to include a dimensioned drawing of all conduits buried on the Site. Conduits to be recorded include conduits in use, future conduit runs (spare conduits), conduit ductbanks and conduit stub-outs. Conduit stub-outs shall also include a dimensioned drawing indicating the end of the conduit run.

   1.2 Use of conduits in the tunnels shall be coordinated with the Rice University’s Project Manager.

2. **PRODUCT STANDARD:**

   2.1 Wireways in wet or damp locations shall be provided with gasketting.

   2.2 In general, warning tape will not be required for buried conduits.

   2.3 Outlet Box: Wall mounted, minimum size of square 4” x 4” x 2 1/8”. Ceiling mounted, minimum size of octagonal 4” x 2 1/8”.

   2.4 In general, non-metallic multi-cell type conduit is not a product that is used for multi-raceway communications.

   2.5 Listed raceway support blocks are used to mount conduits routed across roofing. 2 x 2 wooden blocks are not acceptable.

   2.6 Underground ductbank (less than 600 volts) may be rigid steel conduit, or schedule 40 PVC or EB type (for concrete encasement). At turns, conduit shall transition to rigid conduit. Where conduit exits the ductbank, conduit shall transition to rigid steel conduit. All underground ductbanks (feeders) shall be concrete encased (except where installed by boring). For voltages above 600V, the ductbank shall be red concrete. Underground branch circuits may be direct buried without concrete encasement, provided the minimum distance below grade required per the National Electrical Code is observed.

   2.7 Any conduits used in tunnels to be Rigid Aluminum.

3. **PERFORMANCE STANDARD:**

   3.1 Damp and wet locations above grade generally require rigid conduit. EMT and PVC are not acceptable in these locations.

   3.2 Minimum Size: Conduit home runs (to panelboard) shall be ¾” conduit, minimum. Conduit runs at building exterior and below grade shall be ¾”, minimum. Power conduit runs inside of building to be ½”, minimum. Pullboxes shall be installed in conduit runs such that no conduit run is longer than 100’ and no run has greater than 270 degrees of bends.
3.3 Pull cords shall be provided in all empty conduits for future use. Pull cord to be 270# test, minimum.

3.4 Install raceway runs that exceed 100 feet with a maximum of 270-degrees of bends.

3.5 PVC coated rigid steel conduit: Proper means, methods and materials shall be specified for the installation of PVC coated rigid steel conduit. Installation shall conform to manufacturer’s recommendations. Repair of damaged conduit shall be with manufacturer’s recommended repair compound, applied per manufacturer’s instructions.

3.6 Spare conduits shall be provided at the corners of all new buildings as a means to route future power and signal conductors from inside of the building to outside of the building.

3.7 Location of conduits in the tunnels shall be coordinated with new and existing mechanical and plumbing. Conduits are not to be placed in close proximity of new or existing mechanical or plumbing lines, discuss with Rice University’s Project Manager minimum distance that conduits can be located from mechanical and/or plumbing lines.

3.8 Raceway System Color Code: Emergency power distribution systems shall be RED.

3.9 Raceway System Color Code: Fire alarm systems shall be YELLOW.
1. PRODUCT STANDARD:

1.1 Power pole is as manufactured by Wiremold.

1.2 Raceway to be Steel or Aluminum. No nonmetallic raceway except for data/communications.

1.3 Raceway to be Wiremold series 3000 (minimum) or 4000.

1.4 Contractor shall provide a submittal for proposed power pole and/or other surface metal raceway.

2. PERFORMANCE STANDARD:

2.1 Coordinate color of power pole and other surface metal raceways with Architect.

2.2 Receptacles in factory-wired harness are prohibited. Install wiring devices and branch circuit conductors into power pole and/or other surface metal raceway as required by outlet locations.
1. DESIGN STANDARD:

   1.1 Surge Protective Devices are required at building main switchboards, at distribution switchboards and at distribution panelboards.

2. PRODUCT STANDARD:

   2.1 Surge Protective Devices are to be internal type at switchboards, external type at panelboards.
ADDITIONAL INPUT IS REQUIRED FROM RICE UNIVERSITY NETWORKING GROUP TO FURTHER DEVELOP THIS SECTION.

William Deigarrd, Director Networking,
713-348-5262

1. DESIGN STANDARD:
<published standards, general design criteria, required submittals and shop drawings, overall design philosophy> which portions of work to be done by General Contractor, which portions to be contracted separately by Rice University?

2. PRODUCT STANDARD:
(required manufacturers, required equipment components, required cabling, required misc. parts and pieces>

3. PERFORMANCE STANDARD:
(required installation practices, required acceptance testing, project close-out requirements, etc.>
1. DESIGN STANDARD:

1.1 The design include a reference in the Contract Documents requiring a dimensioned drawing of all ductbank runs below grade on the Site. Conduits to be recorded include conduits in use, future conduit runs (spare conduits), conduit ductbanks and conduit stub-outs. Conduit stub-outs shall also include a dimensioned drawing indicating the end of the conduit run.

1.2 Profile record drawings of the ductbank are not required, but the dimensioned plan view of the ductbank runs shall include the burial depths to the top of duct, noted at various points along the route.

1.3 Use of tunnel system for various conduit ductbanks shall be discussed with the Rice University Project Manager.

2. PRODUCT STANDARD:

2.1 Where below grade, duct to be encased in red concrete, with rebar where PVC conduit is used.

2.2 Where used in tunnel system, ductbank shall be Aluminum conduit. Where routed above grade, not in tunnel system, ductbank shall be Rigid Steel Conduit.

2.3 Where routed below grade, provide Rigid Steel Conduit under non-paved areas, Schedule 40 PVC in paved areas.

2.4 Minimum conduit size in ductbank to be 5".

2.5 In general, no in-grade pullboxes will be allowed in ductbank runs greater than 600 volts. Provide manholes, at least 6’ deep (room to stand). Provide lighting and sump pump in each manhole Manhole cover to be either round or hinged.

2.6 Where PVC is used, ductbank conduit run shall transition to Rigid Steel Conduit elbows at all turns in the ductbank. Rigid Steel Conduit shall also be used where ever the conduits exit the ductbank, either turning or straight

3. PERFORMANCE STANDARDS:

3.1 Install all ductbanks with red concrete encasement.
1. **PRODUCT STANDARD:**

1.1 Receptacles shall be 20 Amp specification grade, side wired type only.

1.2 Wiring devices may be toggle type or rocker type, exact type to be determined by Architect.

1.3 Switches to be 20 Amp.

1.4 Standard color(s) for devices to be determined by Architect.

1.5 Cover plate to be stainless steel in labs, corridors and public areas. Cover plate to be smooth plastic in other finished areas. Cover plate to be galvanized steel in unfinished areas (surface mounted devices).

1.6 Occupancy Sensors to be as manufactured by Wattstopper, Mytech or Novitas.

1.7 Occupancy Sensors are to be provided with “smart sensor technology”, which requires no ladder to adjust the sensor. Smart sensor technology is available from Mytech.

2. **PERFORMANCE STANDARD:**

2.1 Receptacle devices that are vertically mounted shall have the ground pin down. Receptacle devices that are mounted horizontally shall have the ground pin to right.

2.2 Standard mounting height for the devices to comply with ADA requirements.