26 05 01 Electrical Materials and Methods

1. General:
   A. The following are UA preferences that need to be included in drawings and specifications. See additional requirements in other sections of this standard.
   B. The installation of surface mounted raceway and equipment on the exterior of buildings shall be avoided.

2. Power and Communication Utility Poles:
   A. Aerial utilities and utility poles are not acceptable. Special circumstances must be approved in advance by UA Facilities Planning.

3. Underground Power Distribution:
   A. Refer to “Medium Voltage Distribution” section for underground infrastructure. Medium voltage underground ducts must be encased in red concrete with 48 inches of cover minimum.

4. Equipment Layout:
   A. Equipment shall be located and arranged to provide ready access for maintenance. It is especially important to coordinate equipment layout in spaces shared by other systems to insure that these systems do not block adequate working access and code required clearances.
   B. In addition to NEC requirements, it is preferred that ALL electrical room doors swing out. Where electrical room doors swing in, electrical equipment (panelboards, contactors, etc.) shall not be mounted behind the door. Auxiliary equipment mounted behind such doors shall not restrict the door from opening to 90 degrees.
   C. Floor-mounted equipment in electrical/mechanical rooms shall be installed on 4” high housekeeping pads with rounded edges.
   D. The use of troughs for routing branch circuits out of panelboards shall be avoided. In all locations where troughs are utilized, NEC required derating of conductors shall be applied.
   E. Transformer installations shall not infringe on access clearances to other electrical and mechanical equipment. The use of elbows on flexible raceway is recommended.
   F. Design documents shall require the electrical contractor to submit scale shop drawings (1/4” = 1’ min) of electrical rooms indicating actual equipment sizes, locations and code-required clearances. Components of other systems within 6’ of electrical equipment shall be included in these drawings.
5. **Equipment Labeling:**

   A. Provide engraved laminated plastic labels, black with white letters and attached with screws, for all major equipment, including switchboards, panelboards, transformers, disconnects, and control panels. Labels shall identify equipment per construction drawings, and shall indicate the source of power and Room Number. Labels on switchboards panelboards, and transformers shall also indicate voltage.

   B. Provide typed schedules in all panelboards.

   C. Install a label on the face of each receptacle coverplate and tags or wire markers inside the outlet box identifying the panelboard and circuit number from which the outlet is served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of coverplate - black print on clear tape on light colored or stainless steel plates and white print on clear tape on dark colored plates. Embossed tape labels will not be accepted. Install label on the bottom of the plate, centered beneath the receptacle. Use durable wire markers or tags within outlet boxes.

   D. On concealed junction box covers, indicate with permanent marker the source panelboard and circuit numbers of circuits contained within the junction box. Where raceway is exposed in finished spaces, cover may be reversed to conceal marker annotation.

   E. Underground Conduit Warning Tape Installation:

      1) Install continuously along length of pipe 12 to 18 inches above non-ferrous pipe, before final backfilling.

   F. Fire Alarm Labeling:

      1) Paint Junction boxes red with stenciled white lettering “F.A.”. All fire alarm conduits shall be red (continuous).

6. **Dry Type Transformers:**

   A. Transformers shall be ventilated, class H insulation, 150°C. rise, meeting NEMA Standard TP-1 for energy efficiency.

   B. Sound levels shall not exceed the following:

<table>
<thead>
<tr>
<th>KVA</th>
<th>Design Sound Level</th>
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<tbody>
<tr>
<td>0-9</td>
<td>40 dB</td>
</tr>
<tr>
<td>10-50</td>
<td>45 dB</td>
</tr>
<tr>
<td>75-150</td>
<td>50 dB</td>
</tr>
<tr>
<td>225-300</td>
<td>55 dB</td>
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<tr>
<td>500</td>
<td>60 dB</td>
</tr>
</tbody>
</table>

   C. Transformers 30 KVA and above shall have industry standard taps.
D. Transformers shall be provided with appropriate vibration isolation. Spring type isolators shall be provided for transformers 75 KVA and larger.

E. Dry type transformers for buildings shall not be installed outdoors. Transformers shall not be installed above suspended ceilings or in areas with restricted ventilation. Transformers installed on the floor shall be on 4” high concrete housekeeping pads.

F. Transformer installations shall not infringe on access clearances to other electrical and mechanical equipment.

G. All connections to transformers shall be made with flexible conduits, with elbows at the transformer.

7. **Electrical Raceways:**

   A. All conduit raceways above grade shall be metallic. Exception: above-grade conduits containing ground electrode conductors are allowed to be schedule 80 PVC.

   B. All conduits exposed in buildings shall be RGC or IMC to 10’ aff.

   C. Conduits exposed outside of the building envelope, other than those routed in attics, crawl spaces, and electrical/mechanical rooms, shall be RGC or IMC, no exceptions.

   D. Underground conduit raceways may be schedule 40 PVC but elbows and conduit risers up through slabs shall be RGC or IMC. Metal raceways installed below grade shall be PVC coated or protected with a double layer of corrosion protective tape (3M #52 or equal).

   E. All raceway shall be ¾” minimum.

   F. A continuous, stranded #10 THWN trace wire with purple insulation shall be routed with all non-metallic service or feeder conduits routed below grade outside of the building footprint. Where splicing of the trace wire is unavoidable, splices shall be made with waterproof wire nuts. The ends of the trace wire shall be turned up above grade and secured accessible and adjacent to panelboards or equipment.

   G. Conduits shall be securely supported through the use of manufactured supports and/or hangers. Conduit shall not be supported directly from pipe, ductwork, or conduit of other systems. The use of non-metallic ties to support conduits is prohibited.

   H. Junction boxes shall be supported independently of the conduit to the building structure.

   I. Service and feeder conduits entering buildings below grade shall be externally sealed with removable, elastomeric, linked seal assemblies and internally sealed with water block foam sealant equal to Polywater FST. In no case shall below-grade conduits enter the building above or directly into electrical equipment.
J. All branch circuits entering buildings from the exterior shall pass through an exterior junction box. Typical junction box shall be in-ground composite concrete, traffic rated. Where building is subject to flooding through conduit, exterior junction boxes shall be above/below grade type equal to Pencell AG-1730. Circuits shall be gathered to pass through a common junction box where possible.

K. Surface mounted raceways (“Wiremold” or equal) shall be metallic. Non-metallic materials are prohibited.

L. Mogul type LB’s shall be used in lieu of standard LB fittings on all raceways 2” and larger containing electrical power circuits.

M. The use of troughs for routing branch circuits out of panelboards shall be avoided. In all locations where troughs are utilized, NEC required de-rating of conductors shall be applied.

N. The use of MC cable shall be limited to lighting fixture whips. Exceptions may be made for non-academic projects on an individual basis with prior approval.

8. **Wiring Devices:**

   A. Wiring devices shall be specification grade, and shall be rated at 20 amps or above.

   B. Terminations to all devices that are circuited in series on a branch circuit must be made in such a way that removal of one device will not interrupt power to the downstream devices and will not disrupt the integrity of the grounding conductor.

   C. The color of wiring device plates shall be coordinated with the color of plates of other systems.

   D. Individual GFCI receptacles shall be used where required.

   E. External “in use” receptacle outlets shall be metal construction. Cover of outlets shall be flush with exterior construction.

9. **Underground Telecommunication Lines:**

   A. Refer to “Telecommunications” section of this standard. Telecommunication main ducts shall be installed a minimum of 48” below grade. All other Telecommunications ducts shall be installed a minimum 30 inches below grade.

10. **Fire Alarm System:**

    A. Refer to “Fire Alarm” section of this standard.

11. **Lightning Protection System:**

    A. Lightning protection systems shall be UL Master Label certified.
B. Downleaders shall be concealed, no exceptions. Provide sleeves where necessary.

C. Lightning protection system shall have its own driven ground rods and shall be bonded to the building electrical service ground electrode system (outside of the building, if possible). The lightning protection system shall not be grounded to the internal electrical grounding system.