**16050-H: BASIC ELECTRICAL MATERIALS AND METHODS**

**Applicability:**

The information expressed herein is unique to UMHHC owned, operated, and leased facilities, and are intended to supplement the University of Michigan's Architecture, Engineering, and Construction (UMAEC), design guidelines 16050 in regards to color coding. Those UMAEC design guidelines are located on website [http://www.plantext bf.umich.edu /for.archs/index.html](http://www.plantext bf.umich.edu /for.archs/index.html). All information presented in the referenced UMAEC guideline applies to UMHHC facilities, unless explicitly stated otherwise below. Where differences and/or conflicts exist between the supplemental information noted below, and the information in the UMAEC guideline, this supplementary information shall take precedence.

The Design Professional (A/E) shall adhere to UMHHC Design Guidelines for all work at UMHHC facilities. Any requested deviations from these guidelines, shall be sent, in writing, to UMHHC’s Facilities Planning and Development (FP&D). Address the correspondence to the assigned FP&D engineer for the given project. The deviation shall not be incorporated into the construction documents until written approval of the deviation is received by the Design Professional.

The Design Professional is fully responsible for the professional quality, technical accuracy, code compliance, and overall coordination of the contract documents. Compliance with these guidelines shall not be construed so as to relieve the Design Professional of any of that responsibility.

**General**

1. Light switches normally should be located near doorways.
   a. Light switches or control switches/devices at other locations shall be placed to allow a 30” by 48” open access space for handicap persons.
2. Where outlet boxes are used on or in exterior building surfaces, they are to be approved weatherproof cast type with matching flange to receive gasket and fixtures or wiring device.
3. Handy boxes will not be acceptable anywhere.
   a. Outlet boxes with device mounting lugs on the exterior of box openings are not acceptable.
4. Boxes for fixtures, outlets, switches, equipment connections and wire pulling shall be cast or formed from carbon steel sheets of commercial grade steel not less than 14 gauge.
   a. Boxes shall be of one piece construction, zinc or cadmium plated.
   b. Boxes shall be tapped for mounting covers and plates as required.
5. Pull and junction boxes shall be fabricated from code gauge cold rolled carbon steel sheets.
   a. Boxes shall be of welded construction with flat removable covers fastened to the box with machine screws.
   b. All seams and joints shall be closed and reinforced with flanges formed of the same material from which it is constructed or by continuous welding which will provide equivalent strength to flange construction.

**Indoor Raceway Requirements**

1. In accordance with latest version of NFPA 72, provide separate conduits for all Fire Alarm wiring.
   a. Do not install in cable tray.
2. Telecommunication/Data outlets in Patient Room, Operating Rooms, Invasive Procedure Rooms, and like ‘intensive’ spaces shall have 1” raceway installed from the outlet to the tray.
   a. Bond the conduit to the tray using a grounding bushing.
Cable Tray

1. As an alternative, use cable tray in lieu of conduit for telecommunication/data systems per section 16740. See Section 16114 for cable tray.
2. If more than telecommunications are to be installed in the tray, add one or more dividers.
   a. The dividers are needed to isolate and protect these non-TC cables from the weight and movement associated with the TC cables during installation and removals.
3. Trays shall be trapeze (not center) hung for better stability and weight carrying ability, given the dynamic nature of the cabling associated with medical facilities.
4. Provide greater than normal attention to assure working clearance around the tray, for its full length.
   a. Again, given the dynamic nature of the cabling associated with medical facilities, this is essential.
5. No cabling shall be installed so the exit point is from the bottom of the tray.
6. The tray system installed shall have the ability to properly bond the telecommunication conduits.
   a. This is especially true of conduits that are continuous to the outlet boxes (patient rooms, operating rooms, procedure rooms, etc.).
7. Bond the cable tray to the building grounding system.
   a. If cable tray is not continuous, bond sections together.

Cord Reels

1. Cord reels shall never be installed in patient areas.
2. When used in others areas, they shall be spring loaded type.
   a. They shall be capable of being mounted on floors, walls or ceilings.
   b. They shall contain nylon guide rollers, adjustable cable bumpers and a latch mechanism to hold the cable at the desired length.
   c. The reel shall be constructed of heavy gauge material and shall be permanently lubricated at the factory.
      i. They shall be weather-proof and rated for use in the environment specified on the plans.
      ii. They shall be provided with a #12 AWG minimum SOW-A standard cable.

Fire Stopping

1. Fire-stopping shall be installed, using UL standard details (noting materials and construction requirements) appropriate for the material penetrating the fire or smoke barrier, and the construction of that barrier.
2. Fire-stopping of cable trays shall be done:
   a. In a like manner and using UL details, select details that allow for easy removal of media for subsequent installation of more cables, and easy reinstallation of the fire-stopping materials after cable installation.
      i. Fire pillows/bricks’ are an example of this approach
      ii. An even better approach uses intumescent materials that leave the opening open, up until an actual fire or smoke condition becomes present. STI ‘EasyPath’ is an example of this approach. (Other manufacturers have similar systems.)
3. All fireproofing shall be installed by persons certified and trained by the manufacturer or other authorized authority,
4. See Architectural Design Guidelines, Special Requirements, for additional information.

Hazardous Locations

1. When any part of a project's area infers the possibility of use of flammable, explosive, poisonous, or other such hazardous; investigate the issue further, by asking the project manager.
   a. If the issue is still not clear, ask the ‘user’ of the space if such hazardous types of materials are ever present – continuously, sporadically, or in case of accidents.
2. In such cases where they are present provide explosion-proof raceways or other special installations where required by the NEC or environmental conditions.

**Raceway Installation Requirements**

1. Cable tray, conduit, surface raceway fittings and bends shall have bend radii greater than the minimum bend radii of the cables enclosed.
   a. Unless otherwise noted use a radius 10 times diameter of largest cable installed, or 12 times the diameter of the conduit.
2. Run conduit, surface raceways, open wiring on J-Hooks, and cable trays parallel to, or at right angles to building lines.
   a. The requirement on routing of conduits parallel or at right angles to, building lines also applies to conduits installed in slabs.
3. Support electrical equipment and raceways from independent supports.
   a. Supports provided by other trades or supports for other equipment shall not be used.
   b. Use minimum 1/4 inch diameter threaded steel rod hangers, steel channel supports.
   c. Suspended ceiling hangers or hanger wire shall not be used, nor shall other conduits.
   i. **EXCEPTION:** Buildings with very high above ceiling spaces. In these instances the A/E shall give Contractor specific, alternate directions on how to provide needed support for electrical systems. This exception will allow minor work to be done without major disruptions to the ceiling system. Currently, sections of ceiling support grid need to be removed to allow positioning of a ladder large enough to reach the very high slab of the floor above.
4. Provide expansion fittings for all cable tray and conduit installations that cross building expansion joints, building separation lines, and for straight runs where thermal expansion or contraction may cause damage.
   a. Provide bonding at all expansion joints and fittings.

**Accessibility to Equipment Installed In, or Above Ceilings, or in Walls**

1. Provide access doors for all maintainable equipment and junction boxes located behind walls or above permanent (non lay-in) ceilings.
2. Have contractor run conduits, cable tray, and other materials high enough above the accessible ceiling tiles to allow easy removal of the tiles or above access hatches ease of maintenance and inspection.
3. Layout devices in ceilings so there are enough ‘free’ (removable) tiles to allow maintenance of above ceiling equipment, pulling new cables in tray, and making minor additions of new conduits and the like (during renovations).

**MC Cable**

The requirements noted for using MC cable in Campus Guideline 16050, apply also to UMHHC work with two additional requirements:

1. The cable must carry the HCF MC label – HCF stands for Health Care Facilities.
2. The HCF-MC cable may in general only be used for renovation work.
   a. The UMHHC electrical engineer will note if there are any areas where HCF MC cable should not be used (for clinical or other like reasons).

**Design projects to minimize the number of shutdowns, and/or the need to work on energized equipment.**

1. For safety reasons, design the project so work on energized equipment (50+-volts and above) is minimized, or avoided whenever possible.
2. When energized work is unavoidable instruct the contractor to follow the “Procedures Required when Working on Energized Equipment” process.
3. In buildings with generators, it should be assumed that the work on the Normal Power branch must be done with the equipment de-energized.

4. Whenever the apparent danger, noted during design and construction, of de-energizing the equipment is greater than the danger of doing the work energized, the following process must be followed.
   a. Please note to the contractor that this process can take up to two weeks to complete, and that this timing must be considered in project scheduling of shutdowns.

5. Work will be evaluated using a ‘Risk Analysis’ (RA) process.
   a. The UMHHC Electrical Shop will initiate this RA process. The risk analysis considers:
      i. The adverse effects (risks) that are encountered when power is turned off on the affected equipment and all loads fed from this equipment.
         1. These risks would include affects to students, to patients, to staff, to the building, and/or to the building systems.
      ii. The adverse affects, that may occur if an accident occurred, or another equipment failure occurred, while the work is being done on the energized equipment.
         1. These adverse affects obviously include possible injury to the person doing the work.
         2. It also evaluates the affects to students, patients, staff, buildings, and/or building systems were an un-scheduled power outage to occur.

6. If Risk Analysis shows the need to do the work energized, then one of the following two approaches will be taken depending on who will do the work:
   a. If the work is to be done by an electrical contactor (non-U of M employee), the contractor will be notified.
      i. The contractor will then do the work using that company’s “Live Work Process”.
   b. If the work is to be done by a U of M employee:
      i. A U of M ‘Energized Electrical Work Permit’ is processed.
      ii. After all approvals are received, the work can be done.