

**Western Michigan University  
Facilities Management – Engineering Division**

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**DESIGN GUIDELINE:** DG26-0    General Electrical Design Guidelines

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**1. GENERAL DESIGN REQUIREMENTS**

The information presented in these Design Guidelines are for use by the Professional Service Contractor (Professional) in preparation of documents for the University. These are general design requirements and guidelines that apply to the Electrical Division of the University Guidelines. They represent the standard practices and level of quality required for all University projects. Deviations from these Guidelines require written approval from the University's Campus Facilities Department.

In some cases in these guidelines, items of equipment or design practices, are not specified in detail, only guidance is being given. In other cases where specific brands and models are given, (see DG26-10 Preferred Manufacturers List), are University standard equipment and deviation from these standards requires approval in writing.

When the Professional utilizes standard specifications and/or company standard specifications any differences of materials and practices from these guidelines shall be identified to the University Campus Facility Department.

## **2. QUALITY OF WORKMANSHIP & MATERIALS**

The selection, design, and specification of the materials and workmanship to be incorporated into the electrical systems of the project should respond to the demanding environment of a major educational institution providing reliable, durable, low-maintenance, long-life usage, while recognizing the budget constraints for the project.

## **3. INSPECTIONS**

The University's electrical engineer will conduct periodic inspections in which the contractors must comply. The Professional's specifications for the project shall reflect this. During project close-out, the University's engineer and regional electricians will perform an inspection for final acceptance. Most projects will also have a third party commissioning agent involved.

## **4. CODES & STANDARDS**

Codes shall be used as minimum requirements, and where these guidelines call for an installation that exceeds and does not violate the code requirements, these guidelines shall be followed.

All designs and work shall conform to the Professional's Agreement identified edition of the National Electrical Code, Life Safety Code, IBC and State of Michigan requirements. In addition the design and installation shall comply with all the requirements of MIOSHA and OSHA.

All materials used shall conform with the standards of the Underwriter's laboratories in every case where such standards have been established for the particular type of material and/or application in question. All materials shall be labeled as UL listed.

If applicable the Professional's specifications shall require the electrical contractor to obtain and pay for all permits identified and required by the State of Michigan. Local codes and restrictions do not apply.

## **5. BASIC DESIGN, MATERIALS & METHODS**

### **5.1 Design**

Electrical designs in buildings shall include, but not be limited to, separate lighting power, building power and emergency power systems. Emergency power systems shall include both life safety equipment and building load equipment such as telecommunications equipment.

All mechanical rooms shall contain power outlets on each wall for hand tool usage.

Electric heat shall not be used in any building without written permission of the University's Campus Facility Department.

Clocks or time systems are not necessary in University buildings and shall not be installed.

If during the design process, substances are found that require specialized handling, or disposal, the Professional shall identify them to the University's Campus Facility Department in writing as soon as possible.

## **5.2 Arrangement**

All electrical panels shall be located in electrical rooms separated from the rest of the uses of the buildings. No "shared" spaces. Electrical rooms shall be sized large enough to have 25% excess clear wall space after the Professional has located all the equipment and panels in the room. The door of the electrical room shall open off of a public space in the building. Each electrical room shall contain at least one outlet on each wall for hand tool usage. These outlets shall be on a separate circuit.

Telecommunications rooms shall be separate rooms from the electrical spaces. The door to T-com rooms shall also open off of a public space in the building.

## **5.3 Identification**

All components, equipment, wire, wire ways, boxes, and panels shall have identification permanently attached to it in accordance with the specific requirements of the sections to follow. All wire shall be labeled.

Specifications shall require the contractor to provide a building riser diagram (as built version) protectively mounted on the wall of the main electrical room.

Plastic lamacoid nameplates of black letters on white backgrounds shall be attached to all major equipment, panels, disconnects and major feeders throughout the building.

## **6. SUBMITTALS**

### **6.1 Schematic Design Descriptions**

During the Schematic Design Phase prior to the drafting of the specifications, the Professional shall provide a summary design description of the electrical systems in the project. The design description shall give a description of each system, its location, components, applicable to each system, system purpose, how it functions, and the rating of individual components. Also to be included are the Professional's concept of the total system operation, voltages, power consumption, transfer times on energy equipment, etc. A summary of all the project design parameters shall be included. Brochures, bulletins, or catalog sheets shall be included for all major electrical equipment including lighting fixtures.

## **6.2 Design Development Submittals**

The Design Development submittals shall include an update of all the schematic one line diagrams for the building and systems. Outline specifications shall also be submitted edited for the project and equipment. Equipment schedules shall be identified even if they are incomplete. Load calculations for the project shall be included and updated and refined as information becomes available. Cut sheets for major equipment and lighting fixtures should be included in this package.

## **6.3 Drawing Standards**

Only Electrical systems shall be shown on Electrical sheets. Do not combine with Architectural, Mechanical, etc. systems. Each Floor Plan shall have separate drawings for lighting, power, and signal systems. Schedules of equipment shall be located in the drawing set, not in the specification. They should follow or precede the set of Floor Plans. The practice of "filling up" plan sheets should be avoided. All schedules and legends shall be located on the Electrical Plans rather than the specifications.

The Electrical Plans shall include but not limited to the following:

- Electrical Sheet Index (first sheet).
- Electrical Symbol Legend (for all components shown on plans).
- Lighting Fixture Schedule.
- Electrical Equipment Schedule.
- Power Floor Plans.
- Lighting Floor Plans.
- Auxiliary Systems Plans (T-com, Security, Fire Alarm etc).
- Electrical room details.
- Electrical One-Line Diagram.
- Riser diagrams for all major systems.

## **6.4 Construction Document Submittals**

Construction documents shall be complete for bidding. Bidders should not have to design, calculate, figure, or guess at any part of the electrical design. Panel schedules shall be complete, larger size conduit (>2") runs identified, equipment located, and circuit numbers identified.

## **6.5 Fault Current Calculations**

The Professional shall furnish fault current calculations, coordination studies, and panel board load sheets in electronic format to the Campus Facility Engineer prior to the completion of bidding of the project. Final electronic versions of these shall be furnished as "as built" versions at the close of the project.

## **6.6 Shop Drawing Standards**

Contractors shall be required to provide pertinent operational data for each item of equipment; indicating manufacturer, product name, model number, serial number capacity, operating and power characteristics, labels of tested compliances, and similar essential data.

All shop drawings shall be submitted in readable and reproducible electronic format such as Adobe .pdf format.

Shop drawings shall be submitted to the Professional for review, at the same time they shall be submitted to the University's Engineer for review. The Professional shall not return the shop drawings until they have received the University's comments or approval.

## **6.7 Operating and Maintenance Manuals**

When the construction is substantially completed, before the University is expected to operate and maintain the project, the Professional shall provide a complete set of Operation and Maintenance Manuals (O&M's) and System Operation Descriptions to the University in electronic format for review. System Operation Descriptions shall consist of updated and more complete versions of the Design Descriptions written in the Schematic Phase of the project. The O&M's shall, as a minimum, consist of an indexed Adobe pdf file containing the manufacturer's installation, start-up, operation, shut-down, emergency procedures, and maintenance and repair manuals, including spare parts lists for each system component. Manuals shall also include maintenance schedules indicating when the equipment will need servicing and describing the service. The University requires one copy of this information in electronic copy .pdf format burned to compact disc.

## **6.8 As Built Drawings**

The Professional shall provide one complete set of "as built" cad files of the construction and design drawings in AutoCAD format. This shall include a complete set of the electrical specifications in pdf format. The drawings and specifications should include all the changes made by Professional during the job, any markups provided by the Contractor and any changes found by the Professional in the punch-out of the project.

The drawings should include the following information:

- The location of all outlets, fixtures, pull boxes, etc., as installed.
- Complete riser diagrams for power, light, fire alarm, sound, television, telephone, and any special systems.
- Fixture schedules with catalog numbers and manufacturers, as installed.
- Each floor should have separate drawings for light, power, and signal systems.
- Drawings files are to be labeled according to University naming conventions.

## **7. SPARE PARTS & EQUIPMENT**

Spare parts and equipment shall be provided by the contractors through the specifications where ever they are mentioned in these Guidelines.

## **8. WARRANTIES**

Contractor shall be required to assemble the warranties specified in Division 16, in electronic format, tabulated and indexed for easy reference. Provide complete warranty information for each item, product or equipment. Warranty information shall include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

## **9. TEMPORARY ELECTRICAL SERVICE**

Consult with the University regarding temporary electric service for each individual project. The source should be identified in the bidding documents with the voltage, maximum amperage and phasing specified. Connections to existing systems or equipment shall be arranged in advance and shall be made at the convenience of the University. Connections shall be identified clearly and early on the design documents.

## **10. ELECTRICAL INSTALLATION**

The design and installation of electrical equipment shall be to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with a minimum of interference with other installations.

The Professional in their specifications shall indicate sufficient and practical protection for all equipment and materials used on the project.

## **11. CLEANING/TURNOVER**

The Professional shall require in their electrical specifications a cleaning requirement that will include all electrical installations equipment, switchgear, transformers, motor controllers, light fixtures, panels, panel boards, lamps, smoke detectors and lenses prior to final acceptance.

Contractor shall be required in the specifications to replace all inoperative lamps at completion of the project.

*End of Design Guideline*