

5.26.20 LV ELECTRICAL TRANSMISSION DESIGN AND CONSTRUCTION STANDARD

PART 1: GENERAL

1.01 Wiring Devices

- A. This section of the standard includes design requirements for wiring connections, including receptacles and switches to equipment specified in other sections.

1.02 Dry Type Transformers

- A. This section includes enclosed dry type transformers for lighting and power loads, with primaries and secondaries rated 600 volts and less.

1.03 LV Power Factor Capacitors

- A. This section includes unit capacitors for power factor correction.

1.04 Enclosed Switches

- A. This section includes enclosed switches for use as disconnects in service and distribution systems rated 600 volts and less.

1.05 Metal Enclosed Distribution Switchboards

- A. This section includes enclosed dead-front enclosed switchboards for application at 600 volts and less.

1.06 Panelboards

- A. This section includes enclosed fusible switch and circuit breaker panelboards for feeders, and circuit breaker type lighting and appliance branch circuit panelboards.

1.07 Busway

- A. This section includes feeder and plug-in busway in ratings 150 amperes to 5000 amperes, 600 volts and less.

PART 2: PRODUCTS

2.01 Wiring Devices

- A. Electrical Requirements

1. All electrical switches and outlets used shall be equal to Hubbell heavy duty, specification grade or equivalent quality.

5.26.20 LV ELECTRICAL TRANSMISSION DESIGN AND CONSTRUCTION STANDARD

2. Minimum 20 ampere rated switches shall be used for lighting and power loads. In cases where wall dimmers are used, the dimmer shall be solid-state design with flicker noise control. Minimum accepted manufacturer and quality – Lutron Nova T Series.
3. Device faceplates shall be smooth finish hard plastic. Project Service Provide (PSP) shall coordinate color requirements with building architect. Use of vinyl faceplates is strictly prohibited. Galvanized face plates shall be used for all surface mounted devices.

2.02 Dry Type Transformers

- A. Up to 5 kVA: (1ph and 3ph) shall be totally enclosed, self-cooled dry-type with a 150° C insulation system that will not exceed a 80° C rise at a maximum ambient temperature of 40 degrees C.
- B. 5 kVA to 25 kVA: (1ph and 3ph) shall be totally enclosed, solid fill, self cooled with a 180° C insulation system that will not exceed a 110° C rise at maximum ambient temperature of 40 degrees.
- C. 30 kVA and above: shall be open, self-cooled dry-type, designed for free convection of air through the windings with a 220° C insulation system that will not exceed a 150° C rise at maximum ambient temperature of 40 ° C.
- D. Taps in the high voltage winding shall be four each 2-1/2% FCBN for the following ratings: 30 KVA and above, three phase; 5 KVA through 25 KVA, single phase. Taps shall be two each 5% FCBN for all other units except that units rated below 1.0 KVA do not require taps. Additional or smaller taps may be supplied (10% total BN required) if it is the manufacturer's standard.
- E. Transformers used to supply 120 volt lighting or other circuits from 277 volt lighting circuits shall have a Bussmann type HPC fuse holder mounted in the terminal connection compartment, connected to the primary, with a properly rated Bussmann type KTK fuse, removable from outside the connection compartment.
- F. Transformer windings can be copper or aluminum with prior approval.

2.03 LV Power Factor Capacitors

- A. The capacitor unit shall be indoor, metal enclosed, and factory assembled, pre-wired tested and ready for installation.
- B. Capacitor unit shall be sized such that the building will operate at no worse than

5.26.20 LV ELECTRICAL TRANSMISSION DESIGN AND CONSTRUCTION STANDARD

95% power factor.

- C. Capacitor bank shall be rated for a life expectancy of at least 20 years. The enclosure shall be freestanding type NEMA 12. The assembly shall be accessible from the front with a continuously hinged door with a three point locking handle mechanism.
- D. All capacitor cells shall be three phase industrial grade, metal encased, and utilizing threaded type terminals installed with insulating plastic terminal plate. Only three phase units shall be furnished. Single phase units that have been interconnected shall not be allowed. The capacitors shall be specifically designed for power factor correction and continuous duty.
- E. The following control type items shall be included with each assembly:
 - 1. A microprocessor based field programmable automatic power factor controller shall be provided and designed with the following features:
 - a. Digital LED readout or meter indication of actual power factor and power factor setpoint. The setpoint shall be continually adjustable to settings that are leading or lagging from 0.7 inductive to 0.7 capacitive.
 - b. Capacitor step display on number of steps activated and the number available.
 - c. Automatic or manual mode of operation.
 - 2. Instrument transformers shall be provided for the necessary inputs into the automatic controller. Control and potential transformers shall be appropriately fused on both sides of the primary and secondary.
 - 3. Control power transformers shall be provided, if required, for the contractors and associated equipment.

2.04 Enclosed Switches

- A. Use heavy duty type, enclosed switches only.

2.05 Metal Enclosed Distribution Switchboards

- A. Switchgear shall be deadfront construction, rated 600V and shall operate on a 480/277 or 208/120 volt, three-phase, solidly grounded wye, 60 Hz system. The switchboard shall be designed in accordance with the latest NEMA, ANSI, and IEEE standards applicable to this equipment. These standards shall be referenced

5.26.20 LV ELECTRICAL TRANSMISSION DESIGN AND CONSTRUCTION STANDARD

in the project specifications.

- B. Use only circuit breakers in the switchboard. If series rated circuit breakers with current limiting fuses are required due to system fault current the series rating shall be noted and UL listed.
- C. Metering:
 - 1. Coordinate location of metering requirements with The University. If metering at the distribution switchboard is required use the Square D Ion 6200.
- E. Busing
 - 2. The bus shall be insulated copper with a current density of $1000\text{A}/\text{in}^2$. The insulation shall be class B (130 degree C) rated material. Bus connections (including the tie bus) shall be accessible from the rear of the switchboard. All busing shall be braced for the maximum available fault current.
 - 3. Neutral bars shall be full capacity rated.
 - 4. Provide a ground bus through the full length of each section of the switchboard.
 - 5. Provide a disconnecting means for the neutral either in the form of a link, or similar conducting piece, designed to make connection between two suitable terminals or consisting of a terminal plate or stud provided with a suitable wire connection. Simple removal of bolts from a single bus bar is not acceptable.
- F. Professional Service Provider (PSP) shall require the manufacturer to provide a mimic bus. Show bussing, connections and devices in single line form using black laminated plastic strips securely attached on the front panels of the switchboard.
- G. Main and Tie section devices shall be individually mounted and compartmented.
- H. Distribution section devices shall be individually mounted and compartmented.
- I. Auxiliary section devices shall be individually mounted and compartmented.
- J. Provide switchboard on 4" housekeeping pad with suitable angle iron embedded in concrete to allow for proper alignment and anchoring as recommended by the manufacturer.
- K. Future provisions: Switchboard shall be designed with future spaces (15%

5.26.20 LV ELECTRICAL TRANSMISSION DESIGN AND CONSTRUCTION STANDARD

minimum) equipped with breakers and such that the future additions may be readily made in the field.

- L. The power circuit breakers shall be equipped with a solid state tripping system consisting of individual phase monitoring current sensors, a solid state processing device, and a flux transfer shunt trip. The following protective modes or the equivalents shall be provided as a part of the solid state tripping:
 - 1. All breakers shall have long-time pick-up of at least to 1.25 times sensor rating and a long time delay of at least 4 to 36 seconds at 6 times sensor rating.
 - 2. All breakers shall have short time pick-up of at least 4 to 12 times sensor rating and a short delay time of at least to 0.05 seconds at 2.5 times short delay pick-up.
 - 3. Only the feeder breakers shall have instantaneous pick-up (At least 4 to 12 times sensor rating). Instantaneous operation is not required on the Mains or Tie breakers. If provided instantaneous element must be capable of being disabled.
 - 4. Ground fault protection is required and shall include zone interlocking between feeder circuits and the appropriate main breaker.

2.06 Panelboards

- A. Panelboard bus shall be 98% conductivity copper. Bus shall be installed completely throughout panel to permit addition of new bolt-on breakers in available space in future without modifying bus.
- B. All panelboards shall have door locks. The front cover shall be a door in door arrangement with the inner door hinged to allow breaker handle access.

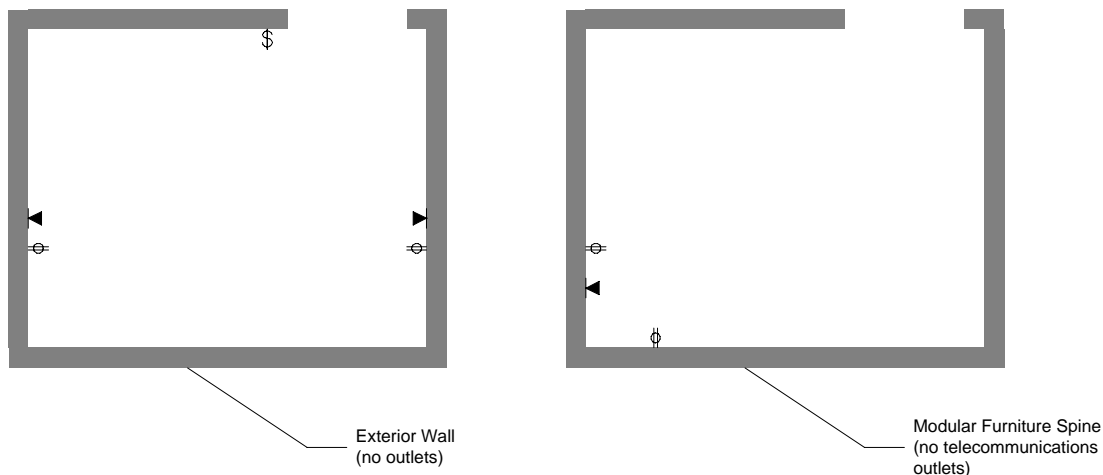
2.07 Busway

- A. Provide copper busway only.
- B. Service entrance busway to be furnished with switchgear And include 240 volt rated space heaters to operate at 120 volts.

5.26.20 LV ELECTRICAL TRANSMISSION DESIGN AND CONSTRUCTION STANDARD

PART 3: EXECUTION

3.01 Wiring Devices



Detail 6.26.20-1: Typical Single Person Office

Detail 6.26.20-2: Typical Open Office Space

- C. A typical single person office space should contain a minimum of two duplex receptacles and (two) communications outlets. Locate the power and data outlets according to the typical office detail 6.26.20-1.
- D. A typical open office cubicle shall contain a minimum of two duplex receptacles and one communications outlet per workstation. Locate the power and data outlets according to the typical office detail 6.26.20-2.
- E. Locate power and communications outlets on interior walls. Do not locate any outlets on exterior walls under windows or on the exterior of the building.
- F. Mounting heights for devices shall be as follows:
 - Wall switches and dimmers -- 48" Aff.
 - Receptacles -- 18" Aff.

Heights are to center of outlet boxes

5.26.20 LV ELECTRICAL TRANSMISSION DESIGN AND CONSTRUCTION STANDARD

3.02 Dry Type Transformers

- A. Larger transformers for facilities shall be designed for location on the ground floor if possible. The PSP is responsible for coordinating maximum transformer weights and anticipated floor loading with the project structural engineer.
- B. Transformers installed in electrical rooms shall be designed and sized in coordination with architect and door dimensions. All transformers sized above 225 kVA shall require double doors or doors in excess of standard 36" width.
- C. Transformers 15 kVA and above are to either be wall mounted or floor mounted on a housekeeping pad . Up to 15 kVA may be wall or trapeze mounted if appropriate for the room layout.
- D. PSP shall provide detail layouts of electrical rooms indicating transformer locations drawn to scale with special mounting instructions as appropriate.
- E. All transformers are to be given an alphanumeric label that will relate the transformer on the room detail to the transformer on the single line diagram.
- F. The single line diagram shall indicate the alphanumeric identifier, the transformer size (kVA), and the primary and secondary voltages.
- G. Transformers for Non-Linear Loads (K-rated) shall be used at the PSP's discretion.

3.03 LV Power Factor Capacitors

- A. The PSP shall show on the single line diagram the planned locations for installing power factor correction capacitor banks.
- B. The drawings shall also indicate location of the capacitor banks in a detail of the electrical room layout.
- C. The capacitor assembly shall be installed a minimum of 200 feet measured along the electrical route from the nearest SCR drive or as indicated in the VFD manufacturer's Harmonic Analysis Study.

3.04 Enclosed Switches

- A. No requirements.

3.05 Metal Enclosed Distribution Switchboards

- A. PSP shall show equipment room layout, drawn to scale, indicating location of

5.26.20 LV ELECTRICAL TRANSMISSION DESIGN AND CONSTRUCTION STANDARD

equipment and busway routing for interconnection.

- B. PSP shall label the switchboard consistently on the single-line diagram and the room layout.
- C. Single-line diagram shall indicate board size and required short circuit rating.
- D. PSP shall furnish a detailed specification indicating detailed control wiring, meter requirements and special construction requirements not outlined in the design standard.

3.06 Panelboards

- A. Branch circuit panelboards shall not serve loads on more than one level of a building.
- B. Molded case circuit breakers shall be bolt-on type only.
- C. Do not mount panelboards in hallways or other public spaces. Where an obsolete panel is being replaced in an existing public space, the new panel shall be flush mounted.
- D. Provide a separate panelboard for labs or other high density electrical utilization equipment spaces where the power requirements exceed 12 poles, and locate the panelboard near the entrance to and within the space. Provide door locks on all panelboards.
- E. Lighting panelboards shall serve only lighting loads and should contain 15% spare capacity in both load and circuit breaker count.
- F. Receptacle panelboards, power distribution panelboards, main switchboards and motor control centers should contain 25% minimum spare capacity in both load and circuit breaker count.
- G. Panelboards should be designed in the electrical room detail layout such that feeder piping is minimized and installed efficiently. Provide a minimum of two 1" empty conduits from each flush mounted panel to an accessible point above the ceiling.
- H. Panelboards shown on single line diagram shall indicate required short circuit amps interrupting capacity (AIC) rating. (may be shown in panel schedules if single-line diagram not appropriate.)
- I. Provide panel locations drawn to scale in electric room detail plans.

5.26.20 LV ELECTRICAL TRANSMISSION DESIGN AND CONSTRUCTION STANDARD

- J. Panelboards shall be labeled with a descriptor indicating location, reference voltage level, primary loads served, and source.
 - K. Panel schedules shall be provided indicating panel size, AIC rating, whether main circuit breaker or main lug only style, main breaker size. Panel schedules shall indicate load information in kVA per phase.
 - L. Distribution panelboards (400A & up) shall have a minimum of 10" of gutter space on both sides.
 - M. Label utilization equipment with circuit number.
- 3.07 Busway
- A. Clearly indicate bus duct ratings and locations on drawings.

END OF STANDARD