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261100-H: SUPPLEMENTAL UNIT SUBSTATIONS

Related Sections

Basis Guideline: 261100 – "Unit Substations"
260800-H – Supplemental Electrical Acceptance Test
260913-H – "Electrical Power Monitoring"
262213-H – "Low Voltage Transformers (16460-H)
7.3 MS 261100 – Unit Substations
NFPA 99 6.4.1.1.1.2 – Health Care Facilities Code
260500 - "Common Work Results for Electrical"
260913-H – Electrical Power Monitoring

For an explanation of the use of these guidelines, see "Design Guidelines for UMHHC Facilities"

Included as part of this UMHHC guideline section are the details described within the following UM Master Specification sections:

7.2 MS 230905 – "Mechanical Systems Controls – Hospital Projects"
Specifically, 3.10.C Network Connections – Devices connected to HITS Network.

Standards: -

All unit substations shall meet the requirements of UL 1558 for low-voltage power circuit breaker switchgear assemblies. The NFPA 99 Health Care Facilities Code references to the design of distribution systems, including arrangements to allow testing and maintenance of system components without disruption of important hospital functions, shall be followed. Follow the U-M Master Specification 261100 "Unit Substations" including Standard Electrical Detail 26110002 for double-ended substations.Items below have been rearranged for clarity

General Requirements

This design guideline is intended to supply the design professional with supplemental criteria for unit substations installed at Michigan Medicine facilities under the electrical technical requirements. Due to the unique nature of the hospital operations versus the university campus, the unit substations shall be designed with future construction services and facilities maintenance requirements to de-energize parts of the substation while minimizing the impact to hospital operations. Continuous monitoring by the UMH Building Utilities building management system is also a key component in the uptime reliability of the unit substations and electrical power distribution.

1. **Circuits from the following classes of power systems and auxiliary systems are only to be grouped in raceways with other circuits of the same class and voltage only; and/or as noted here:**
   a. **Normal power**
   b. **Life Safety Power**
   c. **Critical Power**
   d. **Essential Power (Also referred to as Equipment System in NEC Article 517-30)**
   e. **X-ray, MRI, CT and PET scanners wiring**
   f. **Medium Voltage 5 and 15 kV class es access control systemcables**

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g. **Fire alarm wiring.es (Note: Fire alarm wiring shall preferably be installed in dedicated conduits only. In areas of the corridors, as noted in 283100, the wiring may be installed using dedicated Jdedicated J-Hooks.)**
h. **Security wires may be installed in cable tray or in dedicated J-Hooks.**
i. **Other systems requiring dedicated raceways per manufacturer requirements.**

2. **Whenever possible, sources of Normal, Life Safety, Critical, and Equipment power are to be available within a reasonable distance from any location in the building. I.e., do not provide one Essential Service power panel in the far corner of the lowest level.**
3. **If a service or equipment is no longer required, it is to be removed and all associated wiring is to be removed back to the sources noted below, or equivalent.**
   a. **Power: Back to panel or first junction box where circuit continues on to other, existing, active loads.**
   b. **Telephone and Data wiring: UMH TelecommunicationsMCIT to disconnect wiring at board in communication room and at outlet. Contractor to carefully remove cable.**
   c. **Security, fire alarm, A/V and other Data system or other low voltage and/orspecialor special wiring: Remove wiring back to communication room or other source.**
   d. **Conduit in walls where walls are not otherwise being opened: Abandon in place. Install blank cover plates at outlet boxes, cut off conduit above ceiling or where otherwise accessible, and plug or cap end. If conduit in wall is flex, it shall be removed.**
   e. **Conduit, accessible above ceilings or other locations: Remove conduit, plug open ends at panel.**
4. **Fire stop all holes and openings in floor and at fire or smoke partitionswalls.**
5. **Renovation projects shall include needed work to extend/add services, risers, panels, etc., as needed to serve new functions. If existing services are utilized, the need to maintain the space capacity as noted above will not apply. If any new extensions are required, those extensions shall comply with the space capacity requirements noted above.**

New Equipment Naming

1. **New Panels, services, equipment, etc., shall be labeled, as noted, in Section 16195 for new buildings. Building expansions and renovations shall utilize any naming scheme already in place in that building. A/E shall confirm with UMHS Electrical Engineering the appropriate next sequential name for devices and services in those buildings.**

Equipment Color Codes and LabelingSubstation Components

The substations shall be designed with two identically rated Tie section circuit breakers, typically known as a tie-tie configuration. The two tie breakers allow for the periodic maintenance of each tie in a de-energized condition by only opening one substation main circuit breaker and de-energizing half of the substation. These tie breakers shall be identical to the main breakers and capable of being exchanged with either main breaker.

The substation transfer controls shall have the capability of an automatic, < 100 millisecond, closed transition from the normal dual-sourced operating condition to a single-ended state for main circuit breaker maintenance purposes. The relay controls should contain synchronization relays to enable this closed transition period. The controls should also be capable of a manually

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controlled re-transfer back to the normal operating condition.

The circuit breaker main and tie circuit breaker controls which automatically or manually transfer one or both secondary main busses to the opposite power source shall not be PLC controlled. The controls shall be installed with relays to provide these functions. Provide current limiting fuse protection and disconnect point(s) for test purposes to simulate under-voltage conditions.

The main circuit breaker metering section(s) shall be provided with kilowatt-hour energy meters configured by the installing contractor to communicate with the UMH Building Utilities department Siemens Desigo® building monitoring system (BMS) over BACnet/IP. This functionality may be provided as a feature of the energy meter, or of the single point of connection in the unit substation to the hospital Ethernet network. The main and feeder circuit breaker trip units shall also be capable of communicating power monitoring and remote alarming functions based on metered values to the BMS. The transformer temperature monitors shall also be capable of communicating status and alarm information to the BMS.

1. New wiring, conduits, panels and other electrical equipment shall be color coded and labeled in accordance with Section 260553-H

Fire Alarm, Security, Communications

1. Existing fire alarm, security, intercom, nurse call, BMS, master clock and other similar non-power systems shall be extended unless otherwise noted in program statement. A/E shall confirm capacity of those systems to handle new work and include upgrades if needed.
2. Some older buildings on campus still contain obsolete data outlets and wiring. A/E shall identify the location of these outlets and inform MCIT/UMTel to schedule them to As noted in the program statement or by UMHHC MCIT engineer, update these older outlets. Buildings containing older outlets include, but are not limited to: UH, Mott, Towsley, Women's Hospital and MPB.
3. New buildings (unless noted otherwise in program statement) shall have fire alarm, security, intercom, nurse call, BMS, master clock and other similar "non-power" systems that are compatible with those already being monitored, maintained, operated and/or listed in these guidelines.
4. Coordinate fire alarm work with Fire Alarm Replacement project in process in 2013 through 2016

Operational sequences

1. Sequences of operation and manufacturer's Operating Instruction Manual are to be provided for new or extended systems.
2. Engineer will prepare and review operating and maintenance procedures for the Maintenance Department to review. These procedures shall be noted in the contract documents when bid prices would be affected.
3. Electrical or Communications Closets can not be used for staging or storage during construction.

Future Capacity and Loading Limits for I-2, Critical Facilities, and Other Facilities as Noted in the Program Statement

Please note: All noted spare capacities shall be those at the end of construction. For this reason, designed spare capacity may need to be at least 5-10% more than what is noted below

1. For the services noted below the power source, grounding systems, main switch gear, switchboards, panel boards, transformers and feeders shall all have a minimum: 20% spare kVA (or ampere as appropriate) capacity at the end of construction. [The design loading limit shall be 80% of the nameplate rating – except as noted below.]
    a. Normal power switchboards, panels, MCC's
    b. Life Safety Power switchboards, panels
    c. Essential Power (Equipment System in NEC 517.30) switchboards, panels, MCC's NEC Article 517-30)
    d. X-ray, MRI, CT Power Conditioner and UPS power systems.
    e. 100% rated Substation mains shall not exceed 85% when substation is single-ended.
    f. !00% rated substation feeder breakers shall not exceed 80%

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2. For Critical Power services the power source, grounding systems, main switch gear, switchboards, panel boards, transformers and feeders shall all have a minimum: 3550% spare kVA (or ampere as appropriate) capacity at the end of construction. Said another way, the loading limit is 65% of nameplate rating. The 35% value is selected to allow for all normal power clinical loads to be plugged into the Critical Power receptacles when normal power is lost.
3. Panelboards, switchboards, motor control centers, and switchgear all shall have at the end of construction a minimum:
    a. 20% spare poles, 6 poles minimum for panels
    b. One spare breaker, and space for one 3-pole breaker in substations.
    c. 20% spare mounting inches in switchboards and the equivalent in motor control centers

    **Note: If multiple panels or sections make up an overall unit, the noted spares and spaces may be placed in any of those sections.

4. Generators are to be sized in kVA, for 20% growth in load beyond the additional spare capacity needed to start and operate the largest projected motors with no more than a 10% voltage drop upon start of largest motor, or 2% voltage drop with running or steady-state load. Loading limit on generators shalshall be 80% of the standby rating
5. Interrupting duties and bus ratings are to be based upon maximum future available fault projected by Detroit Edison or Campus Utilities Services. Fault studies shall be performed by A/E before bidding, to confirm adequacy of specified equipment. Review interrupting duties and bus ratings whenever services are upgraded.
6. Communication raceways systems, risers, cable trays, communication closets, will allow for 100% growth in number of conductors installed, in watts of installed equipment in communication rooms, and number of drops installed on the system.
7. Communication rooms will be sized for 30% growth in power and cooling in watts, above those required to serve initially installed equipment and drops.

Future Capacity and Loading Limits for Offsite, and Other non-I-2 FacilitiesBuilding Management System Requirements

Refer to the Master Specification for Mechanical Systems Controls and also the design guideline 260913-H Electrical Power Monitoring for additional detail on this requirement.

The unit substation's single point of connection to the hospital data network shall be approved in advance by the hospital HITS networking group. This typically involves placing a sample of the device, configured as it would be when used in the field, onto the hospital data network for HITS network vulnerability analysis. Any network vulnerability deficiencies identified in the results of the HITS network vulnerability analysis will be remedied by the electrical contractor prior to the completion of the unit substation commissioning.

As indicated in the Master Specification for Mechanical Systems Controls, the unit substations network IP addresses will be issued by the UMH Systems Monitoring group after receiving the BACnet BBMD, MSTP MAC addresses, and other information as required by the BMS Addressing Template spreadsheet.

The electrical contractor shall configure the unit substation's single point of connection to the hospital data network with all of the IP addresses, BACnet Device Instance, and other BMS communication parameters required for use by the hospital Siemens Desigo® BMS integrator.

Commissioning

Perform both pre-commissioning and owner acceptance commissioning activities in accordance with 260800-H Supplemental Electrical Acceptance Test.

END OF SECTION

Please note: All noted spare capacities shall be those at the end of construction. For this

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reason, designed spare capacity may need to be at least 20% more than what is noted below

For the services noted below the power source, grounding systems, main switch gear, switchboards, panel boards, transformers and feeders shall all have a minimum: 20% spare kVA (or ampere as appropriate) capacity at the end of construction. [The design loading limit shall be 80% of the nameplate rating.]

Normal power switchboards, panels, MCC's

Life Safety Power switchboards, panels

Essential Power (Equipment System in NEC 517.30) switchboards, panels, MCC's

X-ray, MRI, CT Power Conditioner and UPS power systems.

For Critical Power services the power source, grounding systems, main switch gear, switchboards, panel boards, transformers and feeders shall all have a minimum: 25% spare kVA (or ampere as appropriate) capacity at the end of construction. Said another way, the loading limit is 75% of nameplate rating The 25% value is selected in part to allow for all normal power clinical loads to be plugged into the Critical Power receptacles when normal power is lost.

Panelboards, switchboards, motor control centers, and switchgear all shall have at the end of construction a minimum:

20% spare poles, 6 poles minimum

One spare breaker and space for one 3-pole breaker in substations.

20% spare mounting inches in switchboards and the equivalent in motor control centers

**Note: If multiple panels or sections make up an overall unit, the noted spares and spaces may be placed in any of those sections.

Generators are to be sized in kVA, for 20% growth in load beyond the additional spare capacity needed to start and operate the largest projected motors with no more than a 20% voltage drop upon start of largest motor, or 2% voltage drop with running or steady-state load.

Interrupting duties and bus ratings are to be based upon maximum future available fault projected by Detroit Edison or Campus Utilities Services. Fault studies shall be performed by A/E before bidding, to confirm adequacy of specified equipment. Review interrupting duties and bus ratings whenever services are upgraded.

Communication raceways systems, risers, cable trays, communication closets, will allow for 50% growth in number of conductors installed, in watts of installed equipment in communication rooms, and number of drops installed on the system.