

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
8. Include diagram and details of proposed mimic bus.
9. Include schematic and wiring diagrams for power, signal, and control wiring.

- C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
4. Circuit directories with load descriptions in electronic format.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Six of each type and rating used. Include spares for potential transformer fuses and control power fuses.
2. Indicating Lights: Two of each size and type.
3. **[Two sets of spare keys for Kirk Key interlocks. Keys shall be received and signed for by the University's Chief Electrician.]**

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by UL and marked for intended location and application.

- C. Use of series rated equipment is prohibited.
- D. Comply with NEMA PB 2.
- E. Comply with NFPA 70.
- F. Comply with UL 891.
- G. Comply with most current edition of the Northwestern University Design Standards.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Remove loose packing and flammable materials from inside switchboards.
- C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.9 PROJECT CONDITIONS

- A. ***(Delete This Paragraph If Not Required)*** [Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by the University or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. **Notify the University's Chief Electrician no fewer than [two] calendar weeks in advance of proposed interruption of electric service.**
 - 2. **Indicate method of providing temporary electric service.**
 - 3. **Do not proceed with interruption of electrical service without the University's Chief Electrician's written permission.**
 - 4. **The University Lock-out/Tag-out procedures shall be used with Contractor controlled locks and tags.**
 - 5. **Comply with NFPA 70E.]**
- B. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- C. Environmental Limitations:
 - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- D. Service Conditions: NEMA PB 2, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.

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2. Altitude not exceeding 6600 feet (2000 m).

- E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards, including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.10 COORDINATION

- A. Coordinate sensor-communication module package with data network and with the University's SCADA system for successful transmission and remote readout of remote monitoring data specified in this Section.

- B. (boar)-6.4(ds)-8()1-6.4((u)-12.21e)cntds with [(t)-13.2((or)-6.3()0.c(k)-20.o1(n7vAT)-c-1.1(r)-6.oduc)-8.1(t)-8.1(i)ac(nc)-8(l)2.9(ear)-6.3n(ac)-8(es)-8(

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- D. Nominal System Voltage: [**480Y/277 V**] [**208Y/120 V**].
- E. Main-Bus Continuous: <Insert ampere rating> A. [Note: **2000 A maximum**]
- F. Factory certified 30 cycle rating.
- G. Indoor Enclosures: 12 gauge Steel, NEMA 250, and Type 1.
- H. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- I. Barriers: Between adjacent switchboard sections.
- J. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.
- K. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- L. Rear Accessible Switchboards: Hinged Rear Doors and Compartment Covers to allow access to rear interior of Switchboard with Corbin #4T3142 key lock as approved by NU Electric Shop. Lock type shall be the same for both campuses.
- M. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments, held with knurled thumb screw retainers.
- N. Provide IR scanning windows in switchboard dead front to allow scan of line and load neit4

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- R. **Optional** [Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.]

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

- A. Surge Protection Device Description: IEEE C62.41-compliant externally mounted, UL 1449 3rd edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:
1. Comply with Division 26 Section "Surge Protective Devices".
 2. Provide a dedicated three pole circuit breaker for the SPD in the switchboard.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Corp. Electrical Group.
 2. Siemens Industry Inc.
 3. Gus Berthold Electric with Eaton Corp. or Siemens

- f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Provide for source breakers for Closed Transition Transfer Switches.
- g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
- h. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
- i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 CIRCUIT BREAKERS – MAIN DEVICES 1600A THROUGH 2000A

- A. Description: Comply with IEEE C37.13 and .16 and UL 1066.
 - 1. *Eaton "Magnum SB" or equal by Siemens, draw out type insulated case power circuit breaker.*
- B. Ratings: As indicated, fully rated, for continuous, interrupting, and short-time current ratings for each circuit breaker; voltage and frequency ratings same as switchgear.
 - 1.

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- L. ***For Main-Tie-Main arrangements*** [Kirk Key Interlocks: Key interlocks shall be provided as indicated on the drawings. Arrange so keys are attached at devices indicated. These interlocks shall keep the circuit breakers trip-free when actuated. Mountings and hardware are included where future installation of key-interlock devices i(y)]TJ40 Tc 0 Teakercn13 .2(a)5.

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3.6 CLEANING

- A. Vacuum dirt and debris from switchboard compartments