Design Standard
Switchboards and Panelboards

Purpose:

This design standard has the purpose of creating a consistent application of switchboard and panelboard requirements throughout the East Side Union High School District, therefore achieving a standard of quality for maintenance, reliability, and operational efficiency throughout all renovation and new building projects.

Design Standard:

1. **General**
    a. Design and specify switchboards, distribution panelboards, and branch panelboards for all power and lighting distribution sources to individual buildings and facilities requiring voltages under 600V.
    b. Design dedicated circuit(s) to serve building automation control panels.
    c. Design dedicated 24-volt circuit(s) to serve temperature control zone air terminal units.
    d. Include required connections to modular furniture and equipment for a complete installation.
    e. Include branch circuiting to power supplies for low voltage systems. Coordinate with Telecom, Data, and Low Voltage sections for electrical requirements.
    f. Include shunt trip circuit breakers where required.

2. **Switchboards**
    Switchboards are to meet the following requirements, based on Code requirements and industry standard of design and care:
    a. Panels shall be provided with “door in door” construction.
    b. Panelboard cabinets shall be mounted plumb and rigid without distortion of box. Mount recessed panels with fronts flush with wall finish.
    c. Install equipment in conformance with workspace requirements of CEC.
    d. Locate equipment in rooms or spaces dedicated to such equipment.
    e. Enclosures:
        i. Free standing, dead front with front accessibility.
        ii. Framework constructed of formed, code gauge steel, rigidly welded and bolted together to support cover plates, bussing, and component devices during shipment and installation. Bolt steel base channels to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.

iii. Provide each section with individually removable top plate and open bottom to permit installation and termination of service and feeder raceways.
iv. Removable Front Covers: Screw attached.
v. Provide removable hinge pins on hinged doors.
vi. Paint interior and exterior surfaces. Medium light gray finish, applied by electro-deposition process over an iron phosphate pretreatment.
vii. All panel boards, switchboards, motor control centers and other components of electrical systems shall be NEMA 1 when enclosed within a building. Except when subjected to moisture, the housing shall be NEMA 3R.
viii. All floor standing equipment shall be mounted on a minimum 4" reinforced concrete housekeeping pad.
ix. All panel boards shall be provided with a minimum of 30% expansion capacity.

f. Bussing:
   i. Material: Plated copper.
   ii. Ground Bus: Full length of switchboard, 50 percent of phase bus capacity.
   iii. Neutral Bus: 100 percent rated, full length of switchboard.
g. Provide fully rated integrated equipment rating greater than the available fault current. Series rated switchboards are not acceptable. Coordinate with serving electric utility. Provide fault current analysis as needed.
h. Lugs: Compression type rated for both aluminum and copper conductors.
i. Molded Case Circuit Breakers are to be NEMA AB 1, with standard frame sizes, trip ratings, and number of poles, and interrupting capacity to meet available fault currents. Molded-case circuit breakers are also identified as:
   i. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.
   ii. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   iii. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
   iv. Instantaneous trip.
   v. Long- and short-time pickup levels.
   vi. Long- and short-time adjustments.
   vii. Ground-fault pickup level, time delay, and I2t response.
   viii. Current-Limiting Circuit Breakers: Frame sizes 400A and smaller; let-through ratings less than NEMA FU 1, RK-5.

ix. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.

j. Enclosed, Insulated-Case Circuit Breaker: Fixed mounting, manually closed, fully rated, encased-power circuit breaker with interrupting capacity rating to meet available fault current.
   i. Two-step, stored energy closing.
   ii. Microprocessor-based trip units with interchangeable rating plug, LED trip indicators, and the following field-adjustable settings:
   iii. Instantaneous trip.
   iv. Long- and short-time pickup levels.
   v. Long- and short-time adjustments.
   vi. Ground-fault pickup level, time delay, and I2t response.
   vii. Remote trip indication and control capability.
   viii. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
   ix. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

3. Sensitive Computer and Network Equipment

Areas of high electrical load density such as computer rooms with servers, and other special service areas shall have dedicated panelboards with 200% rated neutral busses. Also provide TVSS unit at panels serving computer loads. Group clean power loads together onto panels, separating them from dirty power loads and motor loads.

4. Lighting and Appliance Panelboards

Switchboards are to meet the following requirements, based on Code requirements and industry standard of design and care:

a. Enclosures:
   i. Flush Panelboards Rated 400 Amp or Less: Maximum enclosure depth, 5-3/4-inches.
   ii. Wiring Gutter Size: 5 inches at sides, 6 inches top and bottom.
   iii. Finish: Galvanized steel constructed in accordance with UL 50 requirements. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
   iv. Hinged door with door-in-door construction, flush lift latch and lock, two keys per panel. Key panelboards alike, including matching existing on that site.

b. Interior:
   i. Copper bar with suitable electroplating (tin) for corrosion control at connection.
   ii. Provide copper ground bar to accommodate specified terminal lugs.

iii. Predrill bus for bolt-on type circuit breakers.
iv. Provide double lugs or landing pads for feed through feeders.
v. Provide feed through feeder lugs for field connection of multi-section flush panel sections, where applicable.
vi. When distribution panel is feeding isolated ground circuits, provide isolated ground bar, insulated from panelboard enclosure, to accommodate specified terminal lugs.
vii. Provide fully rated integrated equipment rating greater than the available fault current. Coordinate available fault current with serving electric utility. Minimum rating is 10,000 amps. Provide arc flash labeling (typical all panels).
viii. Lugs: Compression type rated for both aluminum and copper conductors.
ix. Provide interior wiring diagram, neutral wiring diagram, UL listed label and short circuit current rating on the interior or in a booklet format inserted in a sleeve inside the panel cover.

c. Main Circuit Breaker, Where Applicable:
   i. UL listed to accept solid or stranded, aluminum or copper conductors. Lugs: suitable for 90C rated wire sized according to the 75C temperature rating per CEC.

d. Branch Circuit Breakers:
   i. Bolt-on type bus connectors.
   ii. UL listed to accept solid or stranded, aluminum or copper conductors. Lugs: suitable for 90C rated wire sized according to the 75C temperature rating per CEC.
   iii. UL listed for use with the following factory installed accessories: shunt trip, auxiliary switch and alarm switch.
   iv. UL listed with the following ratings:
   v. 15 to 125 amp breakers: Heating, Air Conditioning, and Refrigeration (HACR).
   vi. 15 to 30 amp breakers: High Intensity Discharge (HID) lighting.
   vii. 15 to 20 amp breakers: Switch Duty (SWD).
   viii. When indicated on drawings, provide 200 percent rated copper neutral assembly.
   ix. When indicated on drawings, provide an isolated ground bus in addition to the equipment ground bus.

5. Power Distribution Panelboards

Power distribution panelboards to meet the following requirements based on Code requirements and industry standard of design and care:

a. Enclosures:
   i. Provide boxes with removable blank end walls and interior mounting studs. Provide interior support bracket for ease of interior installation.

ii. Finish: Galvanized steel constructed in accordance with UL 50 requirements. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
iii. Hinged door with door-in-door construction, flush lift latch and lock, two keys per panel. Key panelboards alike including matching existing on that site.
iv. Provide IR inspection windows; size and location per good practice.

b. Interior:
i. Copper bar with suitable electroplating (tin) for corrosion control at connection.
ii. Provide copper ground bar to accommodate specified terminal lugs.
iii. Panelboard interior: three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. Molded polyester insulators shall support and provide phase isolation to entire length of bus.
iv. Predrill bus for bolt-on type circuit breakers.
v. Provide double lugs or landing pads for feed through feeders.
vi. Provide feed through feeder lugs for field connection of multi-section flush panel sections.
vii. When distribution panel is feeding isolated ground circuits, provide isolated ground bar, insulated from panelboard enclosure, to accommodate specified terminal lugs.
viii. Fully equip unused spaces for future devices, including manufacturer required connectors and mounting hardware.
ix. Provide fully rated integrated equipment rating greater than the available fault current. See drawings for available fault current. Coordinate available fault current with serving electric utility. Minimum rating is 10,000 amps.
x. Lugs: Compression type rated for both aluminum and copper conductors.
xi. Provide interior wiring diagram, neutral wiring diagram, UL listed label and short circuit current rating on the interior or in a booklet format inserted in a sleeve inside the panel cover.
xii. When indicated on drawings, provide 200 percent rated copper neutral assembly.
xiii. When applicable, provide an isolated ground bus in addition to the equipment ground bus.

6. Instrumentation Equipment

All instrumentation equipment to meet the following requirements based on Code requirements and industry standard of design and care:

a. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

i. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
   - Phase Currents, Each Phase: Plus or minus 1 percent.
   - Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
   - Phase-to Neutral Voltages, Three Phase: Plus or minus 1 percent.
   - Kilowatts: Plus or minus 2 percent.
   - Kilovars: Plus or minus 2 percent.
   - Power Factor: Plus or minus 2 percent.
   - Kilowatt Demand: Plus or minus 2 percent; demand interval programmable from 5 to 60 minutes.
   - Accumulated Energy, kilowatt Hours: Plus or minus 2 percent. Accumulated values unaffected by power outages up to 72 hours.

Approved Manufacturers:

- Square D: all new panels to be Square D
- When expanding the capacity of existing equipment, see Appendix A for legacy panelboard manufacturers.

Substitutes Allowed:

No substitutes allowed.

Pursuant to Section 3400 of the Public Contract Code: Square D panelboards are now in use on the particular public improvement described as East Side Union High School District. At each instance in these specifications that a panelboard is designated by the brand name "Square D", that product is designated to support the existing electrical distribution system that is in place at East Side Union High School District. The Contractor will furnish and apply only "Square D" panelboards as required, and no substitutions shall be deemed to be "or equal" or allowed.

Associated Design Standards and Construction Specifications:

- Division 26 Electrical Design Standards

End of Document

Appendix A: Legacy Panelboard Manufacturers as of March 2010

School Site	Description	Buildings	Legacy Panels	New Panels
Santa Teresa	Original Panel New Remodel Additional Panel New Panel New Panel	400/500/300/Gym Locker Rm/100/800 &100 400/500/300 800 Theatre	I.T.E Siemens G.E Square D Square D	Square D
Oak Grove	Original Panel New Panel New Panel New Panel	Administration Bldg. B/E & C Bldg. X	I.T.E/Zinsco Square D Siemens Cutler Hammer	Square D
Andrew Hill	Original Panel New Panel New Panel New Panel New Panel	Bldg. S Child Care Bldg. 200/300/400 Kitchen	I.E.M Cutler Hammer Cutler Hammer Cutler Hammer Square D	Square D
Yerba Buena	Old Panel New Panel Old/Additional Panel New Panel Old/Additional Old/Additional	Bldg. 300 Bldg. 600 Bldg. 200 Bldg. 800 Bldg. 900	I.T.E Corp G.E. I.T.E./Cutler Hammer Cutler Hammer I.T.E./Square D I.T.E./Cutler Hammer	Square D
Silver Creek	Old Panel New Panel New Panel	Bldg.B/C/D/E & H Bldg. U	Zinsco I.E.M. Cutler Hammer	Square D
Mt. Pleasant	Old Panel New Panel New Panel New Panel Old/New Panel Old/New Panel New Panel	Bldg. 200 Bldg. 400 Bldg. 500 Bldg. 600 Bldg. 800 Theatre	G.E. G.E. Cutler Hammer Square D G.E./Square D G.E./Square D Cutler Hammer	Square D

Evergreen Valley	Original Panel		Square D	Square D
W.C. Overfelt	New Switch Gear Old Panel New Panel Old Panel New Panel Old/New Panel New Panel Old Panel	 Bldg. B Bldg. C Bldg. C Library/Multi Media Child Care Bldg.1000 Wood Shop	Siemens G.E. G.E. I.T.E. Gould Square D G.E./Square D I.E.M. Westinghouse	 Square D
Foothill	Switch Gear/Old Panel New Panel	Bldg. D (Library)	G.E. Siemens	Square D
James Lick	Old Switch Gear/Panel Old/New Panel Old Panel Old Panel Old Panel New Panel New Switch Gear New Panel New Panel New Panel	 Kitchen Multipurpose Pool Mechanical Rm Gym Locker Rm Between Bldgs. 400 300 Stadium and Admin Office 400/300/200/100 Bldg. 1000 Bldg. (Science)	Siera/Columbia Columbia/Siemens Siera I.E.M. G.E. G.E. Siemens/Square D Square D Square D	Square D
Piedmont Hills	Old Switch Gear/Panel Additional Additional New Panel Old/New Panel Old Panel	 Bldg. F Elect Rm Bldg E Elect Rm Bldg. D/E/F Theatre Bldg. G	Siera Co. Siemens/Square D/Cutler Hammer Siemens/Westinghouse/Square D Siemens G.E./Siemens G.E.	Square D

Independence	Old Switch Gear/Panel Old/New Add. Panel Old/New Add. Panel New Panel Old/New Panel Old/New Panel Old Panel Old Panel Old. New Panel New Panel New Panel New Panel Old/New Panel Old/New Panel	 Locker Rm. Bldg. M Large Gym Bldg. M Locker Rm. Bldg. G K Villa Main Kitchen Villa D 300 Bldg. 200,400 Bldg. Villa C Common 200,300,400 Bldg. Villa B 400 Bldg. Bldg. 300, Villa A 300 Bldg. 200 & 400 Bldg.	 F.P.E/I.E.M/I.T.E. I.T.E/Siemens F.P.E./Cutler Hammer Square D F.P.E./Cutler Hammer I.T.E./Siemens I.E.M. F.P.E./I.E.M. I.E.M./G.E. G.E. Square D/G.E. G.E. I.E.M./Siemens/G.E.	Square D