6.4 Mechanical, Electrical, and Plumbing Components

6.4.8 Electrical and Communications Distribution Equipment

6.4.8.2 Electrical Distribution Panels

This category includes electrical distribution panels, either recessed or surface-mounted. Wall-mounted electrical panels have generally performed well in past earthquakes, in part due to their weight (typically less than 200 pounds), the ductility of the sheet metal cabinets, and the strength of the interconnected conduit which can serve as unintended bracing.

Provisions

BUILDING CODE PROVISIONS

Seismic loads for electrical distribution panels are determined using ASCE/SEI 7-10, *Minimum Design Loads for Buildings and Other Structures*, (ASCE, 2010) Chapter 13. The principal objective is to prevent the component from falling.

- ASCE/SEI 7-10 requires anchorage for all equipment in Seismic Design Categories D, E, and F for all equipment weighing over 400 pounds, and items weighing over 20 pounds that are mounted over 4 feet above the floor. Lighter items may be exempt if the component Importance Factor $I_p = 1.0$.
- Items that are exempt from the anchorage requirements noted above are still required to be positively anchored to the structure. The anchorage need not be designed or detailed on the construction documents. They must also be provided with flexible connections between the equipment and associated conduit, if relative motion between the panel and the conduit is possible.

RETROFIT STANDARD PROVISIONS

ASCE/SEI 41-06, *Seismic Rehabilitation of Existing Buildings*, (ASCE, 2007) classifies electrical equipment, including panel boards, as force controlled. These components are subject to the provisions of the standard when the performance level is Immediate Occupancy. The requirements also apply when the performance level is Life Safety in high and moderate seismicity areas, and the equipment is over 6 feet in height and weighs more than 20 pounds. When applicable, electrical equipment meeting any of the following criteria must comply with the requirements of ASCE/SEI 41-06:

- The item weighs more than 400 pounds,

- The item weighs over 20 pounds and is mounted over 4 feet above the floor.
- Building operation equipment.

Acceptance criteria for electrical equipment focus on providing adequate anchorage for seismic forces.

Typical Causes of Damage

- Panels may become dislodged and fall.
- Damage to distribution panels and the attached lines may create electrical hazards and fire hazards.

DAMAGE EXAMPLES

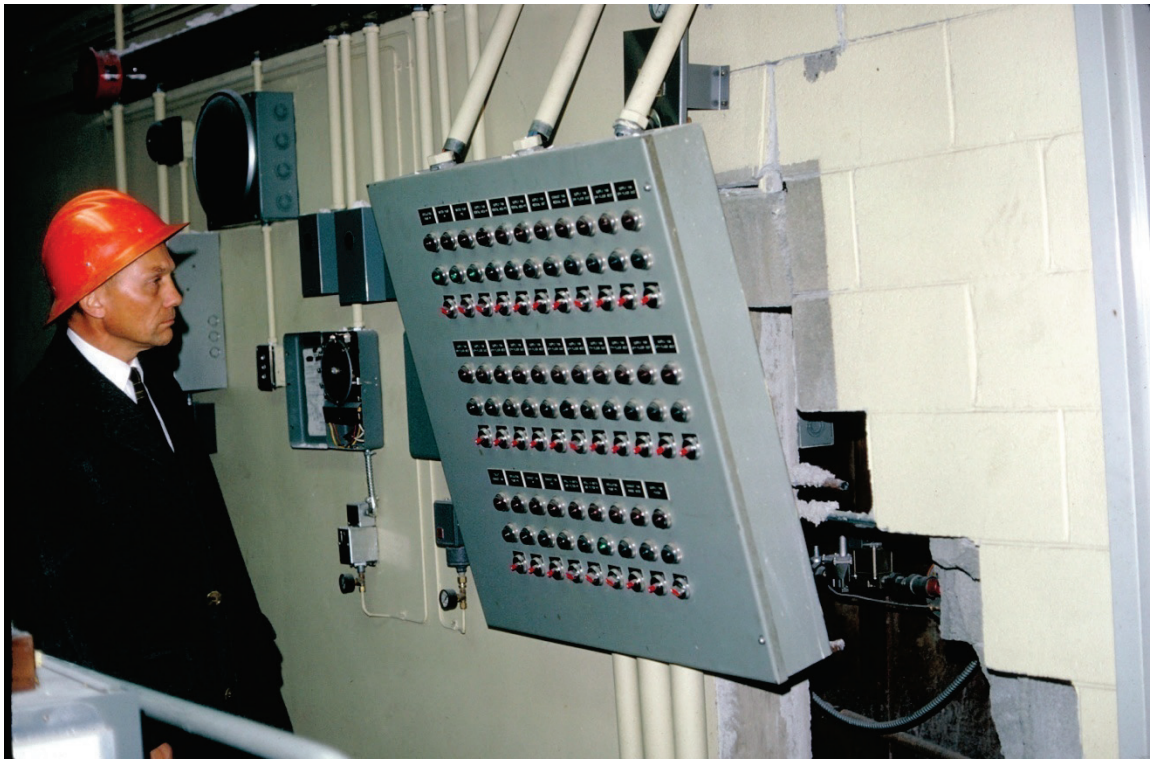

Figure 6.4.8.2-1 Dislodged panel board due to failure of hollow concrete block partition wall in the 1964 magnitude-9.2 Anchorage, Alaska earthquake (Photo courtesy of PEER Steinbrugge Collection, No. S2144).

Seismic Mitigation Considerations

- Working around electrical equipment can be extremely hazardous. Read the Electrical Danger Warning and Guidelines in Section 6.6.8 of this document before proceeding with any work.
- This type of equipment can be supplied with shop welded brackets or predrilled holes for wall anchorage. For any new equipment, request items that can be supplied with seismic anchorage details.
- See Section 6.4.7.1 for additional details. The wall mount detail shown is for a concrete wall; refer to FEMA 413 *Installing Seismic Restraints for Electrical Equipment* (2004) for additional information about anchoring to masonry or drywall and for general information on seismic anchorage of electrical equipment.

MITIGATION EXAMPLES

Figure 6.4.8.2-2 Wall anchorage for electrical panel; standard strut anchored to wall studs and panel anchored to strut (Photo courtesy of Maryann Phipps, Estructure).

MITIGATION DETAILS

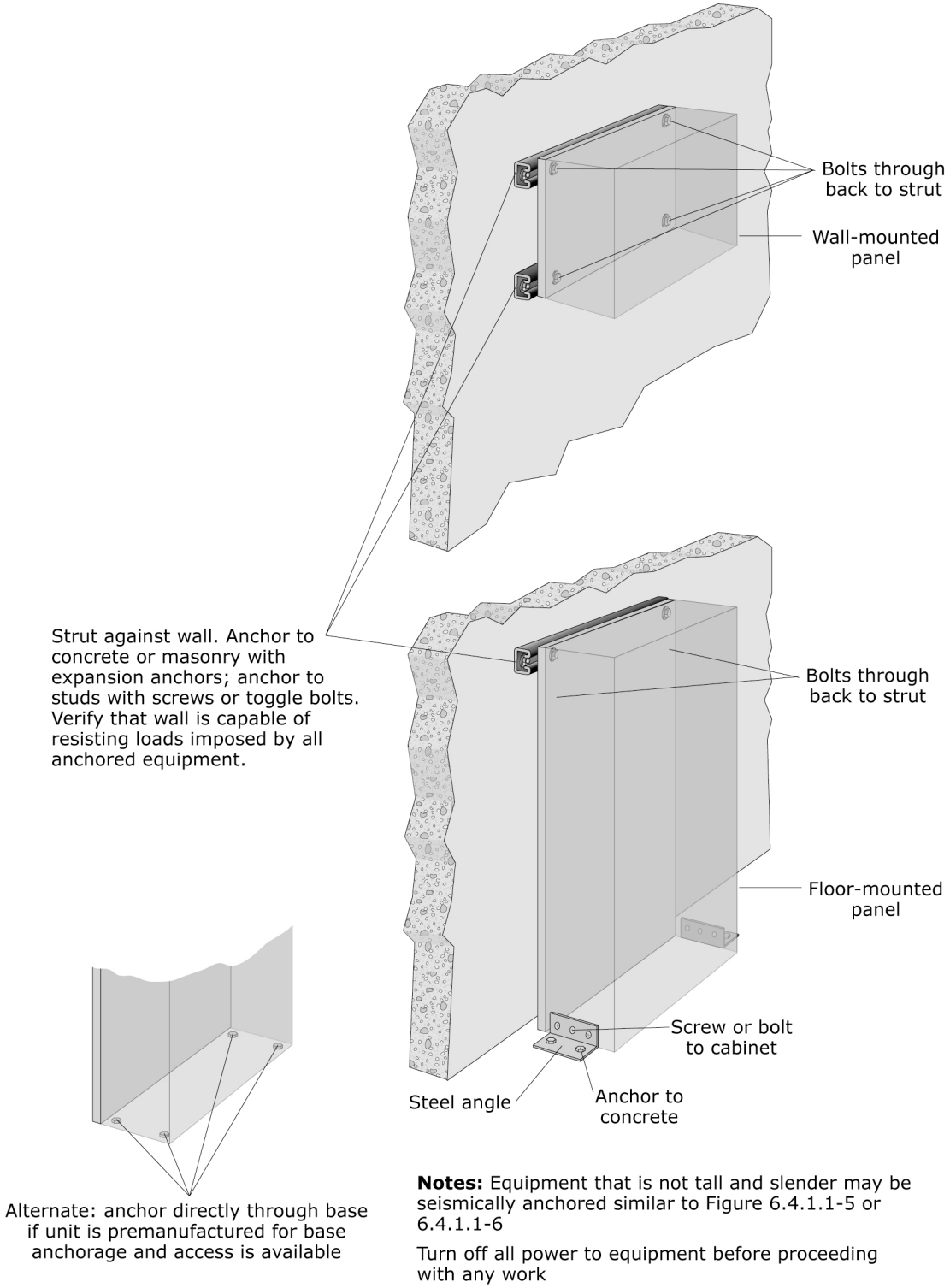

Figure 6.4.8.2-3 Free-standing electrical distribution panel (ER).