Hospital Isolated Power Systems
Isolation Panels

Class 4800
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SECTION 1—INTRODUCTION

This bulletin explains how to install, operate, and maintain Square D isolation panels for hospital isolated power systems. The panel styles described in this bulletin include:

- Operating room (OR) panels
- Intensive care unit and coronary care unit (ICU/CCU) panels, which have the added feature of ground jacks and power receptacles.
- Duplex panels, which have two or more panels in the enclosure.
- Portable X-ray panels that supply power to portable or mobile X-ray units.
- 3-phase panels for specialized equipment such as 3-phase surgical lasers.
- Dual output voltage panels for special applications where the panels can supply a single operating room with two different output voltages simultaneously.

This document is for use by qualified electricians. Please refer to National Electric Code (NEC) Article 517, National Fire Protection Association (NFPA) 99, and other appropriate national and local codes.

GENERAL DESCRIPTION

Except as noted, the specifications below are standard for the United States. Call or write Square D for more information about special equipment, modification, or substitutions. Make sure that all equipment conforms to local codes and standards.

Backbox Package

The backbox is 14-gauge steel. Flush mounting is standard, but surface mounting is available on request.

Interior Package

Subpanel

The subpanel is a single component, which contains the prewired fixture plate and a dead front panel.

Transformers

The transformers for the OR, ICU/CCU, and duplex panels have ratings of 3, 5, 7.5, and 10 kVA. The primary voltage of the transformer can range from 100 to 600 V, depending upon equipment requirements. The secondary voltage of the transformer can range from 100 to 240 V.

The transformers of the portable X-ray and 3-phase panels have 15 and 25 kVA ratings. The primary voltage of the transformer ranges from 208 to 600 V. For single-phase equipment, the secondary voltage can range from 208 to 240 V, depending on equipment requirements. For 3-phase equipment, the secondary voltage of the transformer is 208 V.

The 3 and 5 kVA transformer are factory-installed in the OR and ICU/CCU interiors. For all other models, the transformers are shipped separately and must be installed at the location. For transformer part numbers, see the Square D Digest or the Square D handbook 4800HB9301, Hospital Isolated Power Systems.
Section 1—Introduction

Circuit Breakers

The primary circuit breaker on all panels is sized in accordance with NFPA 70-1996, Article 450-3(b)(1). The number of installed secondary circuit breakers varies with the panel style:

- OR, ICU/CCU, and duplex panels have eight factory-installed 20 A secondary circuit breakers, but are field expandable to 16 circuit breakers.
- 3-phase panels can accommodate up to nine three-pole, 60 A secondary circuit breakers.
- Portable X-ray panels serve a maximum of eight secondary circuits.
- A pushbutton switch in the panel selects which secondary circuit receives power.
- Dual output voltage panels have eight secondary circuit breakers for the 120 V output voltage and one secondary circuit breaker for the 240 V. They also have room for one additional 208/240 V secondary circuit breaker, and the 120 V output voltage panelboard can be field expandable to 16 circuit breakers.

Line Isolation Monitor (LIM)

Each panel comes with one or more ISO-GARD® line isolation monitors (LIM) manufactured by Square D. The LIM continuously monitors the impedance of the total isolated, ungrounded system to ground.

Note: The normal LIM hazard index is 5 milliamperes (mA). However, the hazard index can be switched to 2 mA to meet CSA certification.

Trim Package

The trim is 14-gauge stainless steel. The front cover has a hinged door with lock and key. Flush-mounted models have a one inch flange on all sides for covering uneven edges of the wall opening into which the panel is installed. Flush-mounted duplex panels are designed for mounting at the floor level and do not have a flange on the bottom. Surface-mounted models do not have a flange.

Accessory Package

Optional accessories may be included in the panel design. See Appendix A and B for information on accessories.
SECTION 2—SAFETY PRECAUTIONS

**DANGER**

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

- Only qualified personnel should install, operate, service, or maintain this equipment.

- Successful equipment operation depends on proper handling, installation, and maintenance. Neglecting fundamental installation or maintenance requirements will result in personal injury and damage to electrical equipment or other property.

- Before installing the equipment, disconnect all sources of electrical power. Assume that all circuits are live until they have been completely de-energized, tested, grounded, and tagged. Consider all sources of power, including the possibility of backfeeding.

- Before replacing covers or closing doors, carefully inspect the panel area for tools and objects left in the equipment.

- For safety, have at least two qualified individuals present during installation. **Failure to follow these instructions will result in death or serious injury.**

SECTION 3—RECEIVING, HANDLING AND STORAGE

**RECEIVING**

The backbox may arrive first to allow electrical contractors to begin rough-in work. Before filing claims for shortages, check the details of the order.

Upon receipt, inspect the equipment. If any damage or rough handling is evident, file a damage claim with the carrier immediately. Notify the local Square D field sales office.

**HANDLING**

Isolated power system panels weigh several hundred pounds. To reduce the risk of personal injury or equipment damage, use equipment suitable for lifting and moving heavy loads.

**STORAGE**

Do not store this equipment in damp or dusty conditions.
SECTION 4—INSTALLATION

SUPPORT REQUIREMENTS
Before installing the panel, make sure the structural support can bear the weight of the equipment. Minimum load bearing requirements are as follows:

- OR unit—200 lb (441 kg)
- ICU/CCU unit — 250 lb (551 kg)
- Duplex unit — 495 lb (1091 kg)
- Portable X-ray and 3-phase units—600 lb (1323 kg)
- Dual output voltage unit — 575 lb (1265 kg)

PREPARATION AND ASSEMBLY

The general steps to install the panel and its components are as follows:

1. Mount the backbox. Refer to figures 1–5 on pages 5–7 for backbox dimensions.
2. Install the interior package into the backbox and any accessories. Refer to figures 6–11 on pages 8–10.
   Note: If the panel is fitted for any accessory, remove the closure plate on the panel trim to install the accessory.
3. Install the transformer (if it is 7.5 kVA and larger). See Transformer Installation and Connections on page 11.
3. Make the electrical connections to the loads being served, such as the receptacles, surgical lights, X-ray film viewer, and so forth. See Electrical Connections on page 12 and refer to figures 13–17 on pages 13–17.
4. Install the deadfront panel and stainless steel trim panel.

Backbox Mounting
Shaded areas in figures 1–5 show possible space for routing conduit and fittings. No knockouts or holes for conduit are provided in the backbox. The installer is responsible for drilling additional holes for non-standard mounting and conduit entrances. Front and rear backbox dimensions are the same.

On flush-mounted units, the four 9/16 in (14 mm) mounting holes are located in the backbox, two at the top and two at the bottom. Install the backbox even with the finished wall or recessed no more than 1/4 inch. Do not allow backbox to protrude past the finished wall.

On surface-mounted models, all four 9/16 in (14 mm) mounting holes are located in the rear of the enclosure box.
Backbox Mounting (cont.)

Figure 1: OR and X-ray Panels—Backbox

Optional Accessories
Circuit Breaker Panel
Line Isolation Monitor
14 Gauge Stainless Steel
Hinged Door with Lock and Key

(4) .562 Dia. Holes
(2 Top, 2 Bottom For Mounting)

Shaded areas denote possible conduit entrance

3 and 5 kVA
Flush Mounted

3 and 5 kVA
Surface Mounted

7.5 through 25 kVA
Flush Mounted

7.5 through 25 kVA
Surface Mounted
Backbox Mounting (cont.)

### 3 and 5 kVA

- **Flush Mounted**
- **Surface Mounted**

### 7.5 through 25 kVA

- **Flush Mounted**
- **Surface Mounted**

**Figure 2: ICU/CCU Panel—Backbox**
Backbox Mounting (cont.)

- Shaded areas denote possible conduit entrance

**Figure 3: Duplex Panel—Backbox**

- Surface Mounted
- Surface Mounted 15 and 25 kVA

- Shaded areas denote possible conduit entrance

**Figure 4: 3-Phase Panel—Backbox**

- Flush Mounted
- Surface Mounted
- Surface Mounted 15 and 25 kVA

**Figure 5: Dual Output Voltage Panel—Backbox**

- Rush Mounted 3 and 5 kVA
- Rush Mounted 7.5 and 10 kVA

Shaded areas denote possible conduit entrance
Assembly

Figure 6: OR and ICU/CCU Panels 3.0 and 5.0 kVA—Assembly

Figure 7: OR and ICU/CCU Panels 7.5 and 10 kVA —Assembly
Assembly (cont.)

Figure 8: Duplex Panel — Assembly

Figure 9: X-ray Panel — Assembly
Assembly (cont.)

Figure 10: 3-Phase Panel—Assembly

Figure 11: Dual Output Voltage Panel—Assembly
TRANSFORMER INSTALLATION

Small transformers rated 3 or 5 kVA are installed onto the panel interior assembly at the factory. Transformers rated 7.5 kVA and larger must be installed into the panel on location.

Vibration Pads

The transformers are equipped with vibration pads to reduce vibration and dampen sound caused by transformer vibration. Before shipping, transformers rated at 3 and 5 kVA are securely bolted to the subpanel with four retaining nuts. After installing the panel and its components, loosen the transformer retaining nuts to allow the rubber pads to absorb the vibration. If left compressed, the pads may not dampen the noise.

On larger transformers 7.5 kVA and larger, the vibration pads are not factory installed.

Transformer Installation

Transformers that are 7.5 kVA or greater can weigh 150–500 lbs (330–1100 kg), and therefore require special handling. Depending on the panel design, the transformers are installed either on the top half or the bottom half of the backbox. Refer to the approval drawing for the specific location. If on the top, install the transformers on the mounting angles with nuts and bolts. If on the bottom, install the transformers over the studs. Reuse the hardware from the shipping pallet.

Orient the transformers in the enclosure to allow the leads to extend out from the front. This makes wiring to the primary circuit breaker and panelboard easier.

Transformer Electrical Connections

To make electrical connections to the transformer, refer to figures 13–17 on pages 13–17.
ELECTRICAL CONNECTIONS

The electrical connections required at the installation site are the following:
1. Connection of the main power feeder.
2. Connection of the reference ground bus to the ground lug on the terminal board.
3. Connection of the remote indicator alarms to the LIM.

Connect the secondary circuits to the contactors or to the panel board circuit breakers in the subpanel. The contactor terminals are marked and fitted with a lug to make connection easier. The consulting engineer specifies the wire size.

The color coding for the secondary circuit is as follows:
- Orange—isolated conductor No. 1
- Brown—isolated conductor No. 2
- Green—grounding ground
- Yellow—isolated conductor No. 3 (3-phase)

For specific connections, refer to figures 13–17 on pages 13–17.

Wire Quality Requirements

Square D recommends using cross-linked polyethylene wire with a dielectric constant of 3.5 or less. The most widely available wire for this application is low-leakage wire #FR-XLP (VW-1 XHHW-2) from Rome Cable Corporation.

Note: Always specify a dielectric constant of 3.5 or less when purchasing wire. Avoid wires with a high carbon filler, which produce substantial leakage in an isolated power system. Make sure the wire is the appropriate size for transformer and meets local code requirements.

Grounding

DANGER

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION BECAUSE OF IMPROPER GROUNDING CONNECTIONS

Isolated power system panels for healthcare facilities are not grounded in the same manner as many other types of electrical equipment. Before proceeding, read this section, study the wiring diagram and applicable codes, and thoroughly understand the special grounding requirements for this type of system.

Failure to observe these precautions will result in death, severe personal injury, or equipment damage.

Isolated power systems for healthcare facilities have special grounding requirements to reduce electrical hazards to patients. Note that the reference grounding point is not the grounded or neutral conductor. The ground bus in the isolation panel is the reference grounding point for the room as defined by NFPA 70, Article 517. Use only one conductor to connect the ground bus in the isolation panel to the ground bar of facility’s main ground system. The main ground system is the distribution panel that feeds power to the isolation panel. Connect all green ground conductors from the equipment in the patient care area served by the isolation panel to the ground bus in the isolation panel.

If more than one isolation panel is serving the area, connect both ground buses (reference grounding points) together with a large conductor, or see the consulting engineer’s design, or contact Square D.

To ground transformers that are 7.5 kVA and larger, which are shipped separately, connect the lead from the electrostatic shield of the transformer to the ground bus in the isolation panel.
ELECTRICAL CONNECTIONS (cont.)

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

- Turn off all sources of power before beginning.
- Do not use wire pulling lubricant of any type on the secondary circuits.
- Conduit must be clean and dry.
- Maintain identical phasing throughout the installation.

Failure to observe these precautions will result in death, severe personal injury, or equipment damage.

Figure 13: OR Panel—Electrical Connections
ELECTRICAL CONNECTIONS (cont.)

Figure 14: ICU/CCU Panel—Electrical Connections
ELECTRICAL CONNECTIONS
(cont.)

Station "A" shown; other stations wired similarly

Note: Maximum of 8 outlets
Do not exceed a length of 150 Feet (45.72 Meters) for branch circuit
For single-phase X-ray panels, connect the secondary circuits to the contactors in the subpanel. The contactors are marked and fitted with a lug.

Figure 15: X-ray Panel—Electrical Connections
ELECTRICAL CONNECTIONS (cont.)

Note: Use a 4-wire system to supply the primary. For 3-phase panels, connect the secondary circuits to the secondary branch circuit breakers.

Figure 16: 3-Phase Panel—Electrical Connections
ELECTRICAL CONNECTIONS
(cont.)

Figure 17: Dual Output Voltage Panel—Electrical Connections

FINAL INSPECTION AND TESTING

NFPA 99-1996 requires that isolated power systems be tested in accordance with 3-3.3.4.2 Isolated Power Systems, 3-3.3.2.1 Grounding Systems in Patient Care Areas, 3-3.2.2.2 Impedance of Isolated Wiring, and 3-6.4.2 Record Keeping.

A Square D field service representative is available to perform all the tests required by NFPA 99. Contact your local field office to order this service.
SECTION 5—OPERATION

Operation of the line isolation monitor (LIM) is described in the instruction bulletin shipped with the LIM.

The X-ray isolation panel has a secondary circuit breaker that is connected to a maximum eight branch circuits. Only one secondary circuit can receive power at a time. The pushbuttons used to select a secondary circuit are located on the X-ray panel as shown in figure 18, or located in a convenient remote station such as a nurses station.

To select a secondary circuit, press the pushbutton for that circuit. The red pushbutton at the bottom of the column clears all secondary circuits. No power will be delivered to a secondary circuit until the secondary breaker is closed.

Figure 18: X-ray Panel Secondary Circuit Pushbutton Selectors
SECTION 6—MAINTENANCE

Conduct periodic testing in accordance with chapter 3 of NFPA 99 and any applicable local codes. Call the local Square D field office to obtain the services of a Square D factory technician.

The only parts necessary to stock are the fuses for the Square D line isolation monitor and the lamps for the indicator alarms (see Appendix A), as follows:

- Wickmann type TR5-T, 250 mA fuses (Square D part number 25499-12821).
- Chicago Miniature No. 382 lamps for the HAZARD and SILENCE indicators.
- The SAFE LED indicator light is Starled part number MF636CC5-12VAC/40 (Square D part number 43133-143-01).

**Note:** To return the LIM to the factory for any reason, first obtain an authorization and a return material number from the local Square D field office. Pack the LIM carefully to avoid shipping damages.
APPENDIX A—OPTIONAL LIM INDICATOR ALARM

Panel-mounted indicator alarms are optional accessories that indicate the condition of the line isolation monitor (LIM). Three models are available: ORIC-A, ORIC-AC, and ORIC-A5C. All three models have an audible alarm and indicator lights. The ORIC-AC has the added feature of a 2 mA microammeter and ORIC-A5C includes the 5 mA microammeter.

The remote indicator alarm (catalog number IA-1C) is mounted on a two-gang faceplate. No backbox is provided with this unit; however, a two-gang deep masonry box is available from your local Square D distributor.

**ALARM INSTALLATION**

The indicator alarm terminal block is connected directly to the LIM terminal board. Use #16 or #18 TW stranded insulated wire for all remote alarm connections. Because the circuits are low voltage, the wires do not contribute leakage current to the system and low-leakage wire is not needed. However, 600 V insulation is required for these wires.

The terminal board of the ISO-GARD LIM has a set of normally open and normally closed dry contacts. The contact notation on the terminal board indicates their position in the safe condition.

**Panel-Mounted Indicator Alarm**

Connect the terminals labeled 1, 2, 3, Meter, and LIM Ground on the indicator alarm terminal block to the corresponding terminals on the ISO-GARD LIM terminal board.

**Note:** Terminals labeled Meter and LIM Ground are not used on all units.

**Remote Indicator Alarm**

On the terminal block of the remote indicator alarm, locate terminals 1, 2, and 3. Connect those terminals to the terminal block points 1, 2, and 3 on the ISO-GARD LIM terminal board in the isolation panel. Refer to figure 20 on page 21.

When using more than one indicator alarm, wire the alarms in parallel, except for the remote meters. Wire the remote meters in series.
ALARM OPERATION

SAFE Indication
The green SAFE indicator light is on whenever the LIM to which it is connected is energized and operating normally.

HAZARD Indication
When a fault occurs, the green SAFE indicator light goes out and the red HAZARD indicator light comes on. The audible alarm also activates. When the fault is corrected, the red HAZARD indicator light goes out, the audible alarm silences, and the green SAFE indicator comes back on automatically. The indicator alarm is ready to indicate the next fault.

Alarm Silencing
To silence the alarm during a fault, press the SAFE/SILENCE pushbutton. The amber SILENCE indicator light comes on. The red HAZARD indicator light remains on until the fault is corrected.

Notes:
1. Connector Pin Functions:
   1. L1 Input Vac
   2. L2 Input Vac
   3. L3 Input Vac
   4. Ground
   5. Blank
   6. RS-232
   7. Test
   8. Meter +
   9. LIM Common (Meter –)
   10. 12 Vac Common
   11. 12 Vac Hazard
   12. 12 Vac Safe
   13. K1 Safe
   14. K1 Common
   15. K1 Hazard
2. LIM internal power supply provides 12 Vac (5 VA max.) to remote indicator alarms. Square D indicator alarm (catalog # IA-1C or # M5-IAI) is recommended.
3. Remote indicator alarms requiring 12 VAC at more than 5VA, or requiring voltage other than 12Vac, can be powered by an independent power supply connected as shown and switched by LIM relay K1 contacts (1.5 A at 120 Vac max.)

Figure 20: Remote Indicator Alarm Wiring Diagram
APPENDIX B—OPTIONAL EQUIPMENT

Additional optional equipment is available, including the following:

• X-ray receptacles with indicator alarm
• Remote X-ray supervisory modules
• Power/ground modules
• Master grounding station module
• Ground cord assemblies
• Digital clocks, timers and accessories

For further details, see the *Square D Digest* or Handbook 4800HB9301, “Hospital Isolated Power Systems.”