1. GENERAL
	1. SUMMARY
		1. This Section includes hospital isolated power distribution panels, including the following type(s):

{Specifier: Delete panel types below along with associated items in Section 2 when not specified per project}

* + - 1. Isolation Distribution Panels
			2. Duplex Isolation Distribution Panels
			3. Laser Isolation Distribution Panels
			4. Dual Voltage Isolation Distribution Panels
		1. Related Sections include:
			1. Section 26xxxx “Power and Ground Modules”
	1. SCOPE
		1. The contractor shall furnish, install, and ensure proper testing and certification of a complete isolated power system, including associated accessories, as indicated on the electrical plans, wiring diagrams, panel schedules, and as specified herein.
	2. SUBMITTALS
		1. Product Data: Provide dimensions, ratings, operating characteristics, and included accessories.
		2. Installation/Operation Instructions: Provide instructions for handling, installation, and operation of product.
	3. REferenceS
		1. NFPA 70 – National Electric Code, Article 517 – Health Care Facilities
		2. NFPA 99 – Health Care Facilities Code
		3. UL 1022 – Line Isolation Monitors
		4. UL 1047 – Isolated Power System Equipment
		5. UL 50 – Enclosures for Electrical Equipment
	4. Approved manufacturers
		1. This specification is based on equipment manufactured by PG LifeLink (formerly Post Glover Medical).
		2. Products of other manufacturers will be considered provided they are equal in all respects and request for approval is submitted in writing to the engineer at least 2 weeks prior to the bid date.
	5. REGULATORY REQUIREMENTS
		1. Isolated Power Systems shall be designed and tested in accordance with the requirements of NFPA 99 – Healthcare Facilities Code (2012 Edition) – Chapter 6 Electrical Systems.
		2. Isolated Power Systems shall be installed in accordance with the requirements of NFPA 70 – National Electric Code (most recent edition) – Article 517 Health Care Facilities.
		3. Isolated Power Systems shall be fully Listed to UL 1047 – Isolated Power Systems Equipment.
1. products

{Specifier: Delete panel type sections below as required per project}

* 1. Isolation Distribution Panels
		1. Provide Isolation Distribution Panels for all operating rooms and other critical procedure areas as indicated on contract drawings. Isolation Distribution Panels are intended to serve medical equipment in a single patient area.
		2. Isolation Distribution Panels shall be a three‑piece assembly consisting of: back box, component chassis, and front trim. For ease of installation, component chassis shall be pre-assembled, pre-wired, and shall contain isolation transformer, Line Isolation Monitor (LIM), primary main and total quantity of factory installed secondary branch circuit breakers as indicated on panel schedule(s).
		3. Panels shall be single-phase with primary and secondary voltage and load ratings as indicated on panel schedule(s).
		4. Enclosure depth shall be a maximum of eight inches for units up to 10kVA.
		5. Panels shall be flush mount. Back boxes shall be available for shipment during rough-in construction stage. Pre-wired component chassis and front trim shipped according to construction schedule.
		6. Where contract drawings call for panels to be installed outside of the room being served, a Remote Annunciator connected to the Line Isolation Monitor shall be installed inside the room.
		7. Panels shall include provisions for future field upgrades, including: system load monitor, individual branch circuit load monitor, fault location system, and/or device communication network.
		8. PG LifeLink model IPP-P panels shall be basis for design.
	2. Duplex Isolation Distribution Panel
		1. Provide Duplex Isolation Distribution Panels for all operating rooms and other critical procedure areas as indicated on contract drawings. Duplex Isolation Distribution Panels are intended to serve medical equipment in a single patient area where more than one system is required.
		2. Duplex Isolation Distribution Panels shall contain two independent isolation systems, physically separated by a barrier. Panels shall be pre-assembled and pre-wired, and shall contain two each: isolation transformers, Line Isolation Monitors (LIM), primary mains and two sets of secondary branch circuit breakers factory installed as indicated on panel schedule(s).
		3. Panels shall be single-phase with primary and secondary voltage and load ratings as indicated on panel schedule(s).
		4. Enclosure depth shall be a maximum of eight inches for units up to 10kVA for each isolated system.
		5. Panels shall be flush mount. Back boxes shall be available for shipment during rough-in construction stage. Pre-wired component chassis and front trim shipped according to construction schedule.
		6. Where contract drawings call for panels to be installed outside of the room being served, Remote Annunciators connected to the Line Isolation Monitors shall be installed inside the room.
		7. Panels shall include provisions for future field upgrades, including: system load monitor, individual branch circuit load monitor, fault location system, and/or device communication network.
		8. PG LifeLink model IPX-P panels shall be basis for design.
	3. Laser Isolation Distribution Panel
		1. Provide Laser Isolation Distribution Panels to serve discrete device loads in multiple operating rooms and other critical procedure areas as indicated on contract drawings. Laser Isolation Panels serve 208 or 240V portable equipment, such as medical lasers in several nearby patient areas from a centrally installed location.
		2. Laser Isolation Distribution Panel device chassis shall be pre-assembled and pre-wired and shall contain: Line Isolation Monitor (LIM), programmable control system, primary main and total quantity of secondary branch circuit breakers and associated contactors as indicated on panel schedule(s).
		3. System shall include contactor control system with programmable lock-out feature to protect against accidental shutdown or overload of primary main circuit breaker.
		4. Panels shall be single-phase with primary and secondary voltage and load ratings as indicated on panel schedule(s).
		5. Enclosure depth shall be a maximum of twelve inches for units up to 25kVA for each isolated system.
		6. Panels shall be flush mount. Back boxes shall be available for shipment during rough-in construction stage. Pre-wired component chassis, isolation transformer, and front trim shall be shipped according to construction schedule.
		7. Each branch circuit being served by Laser Isolation Distribution Panel shall include a Laser Outlet Module for connection of equipment loads. Laser Outlet Modules shall be installed inside each procedure room per the contract drawings and shall be wired back to associated Laser Distribution Panel and indicated on project drawings. Modules shall include: 8”H x 12”W x 4”D steel backbox, stainless steel front trim panel with hinged door over NEMA {Specify: L6-20R, L6-30R, L6-50R} receptacle, door activated control switch, and Remote Annunciator connected to Line Isolation Monitor at associated Laser Isolation Distribution Panel.

{Specifier: If site conditions require that portable laser receptacles must be installed on equipment boom or other location which will not accommodate full Laser Outlet Module above, contact PG LifeLink to assist in design and specification of custom control applications}

{Specifier: The following feature is optional, delete section if not required for project}

* + 1. Laser Isolation System shall include remote relay modules which activate “Laser-in-Use” illuminated sign(s) at room entrance(s) whenever local Laser Isolation circuit is energized via Laser Outlet Module. PG LifeLink model CLR Control Relay Modules shall be basis for design.
		2. PG LifeLink model IPL-P Panels with DLO-R Laser Outlet Modules shall be basis for design.
	1. Dual Voltage Isolation Distribution Panel
		1. Provide Dual Voltage Isolation Distribution Panels for all operating rooms and other critical procedure areas as indicated on contract drawings. Dual Voltage panels simultaneously serve both 120V medical equipment and 208 or 240V portable medical laser equipment within a single procedure room from a single panel.
		2. Dual Voltage Isolation Distribution Panels shall contain a single isolation transformer with a single input and dual output windings (120V and {Specify: 208V or 240V}). Panels shall be pre-assembled and shall contain two Line Isolation Monitors (LIM), one primary main circuit breaker, and two sets of secondary branch circuit breakers as indicated on panel schedule(s).
		3. Panels shall be single-phase with primary and secondary voltages and load ratings as indicated on panel schedule(s).
		4. Enclosure depth shall be maximum twelve inches.
		5. Panels shall be flush mount. Back boxes shall be available for shipment during rough-in construction stage. Pre-wired component chassis and front trim shipped according to construction schedule.
		6. Where contract drawings call for panels to be installed outside of the room being served, a Remote Annunciator connected to the Line Isolation Monitor shall be installed inside the room.
		7. Panels shall include provisions for future field upgrades, including: system load monitor, individual branch circuit load monitor, fault location system, and/or device communication network.
		8. PG LifeLink model IPD-P panels shall be basis for design.
	2. components
		1. Enclosure
			1. Back-box shall be fabricated of galvanized steel in accordance with UL 50 and shall be flush mounted, unless indicated otherwise, at the elevation shown on the contract drawings.
		2. Front Trim
			1. The front trim shall be constructed of type 304 stainless steel with a #4 brushed finish and shall be secured by 1/4-20 stainless steel screws.
			2. A lockable hinged door shall provide access to operate circuit breakers. The breaker access door shall not obscure the LIM(s) even when open. All locks shall be keyed the same.
			3. Front trim shall mount to the back-box via a set of compound, lift-off, slide-hinges that allow trim to pivot open for easy access during testing and maintenance without need for full removal or realignment. This ‘door-in-door’ feature shall not require an exposed seam.
			4. All hinges shall be fully concealed to facilitate regular cleaning/disinfecting of entire trim surface.
			5. The maximum temperature rise at the surface of the front trim shall not exceed 30° C above room ambient under full load conditions.
		3. Chassis
			1. All Components within the isolation panel shall be mounted to a removable chassis plate and pre‑wired at the factory in accordance with UL requirements.
			2. A terminal block shall be provided for connection of remote signal and communication conductors from the LIM.
			3. The total leakage current of the system shall not exceed the maximum values in Table 30.1 of UL 1047.
		4. Hospital Grade Isolation Transformers
			1. The Hospital Isolation Transformer shall be single phase, 60 Hz, with kVA rating, primary voltage, and secondary voltage(s) as indicated on the panel schedules and/or project drawings.
			2. The isolation transformer shall be of stacked core design with an electrostatic shield between the primary and secondary windings to prevent direct shorting, and to reduce coupling of harmonic distortions between the windings. The shield shall be grounded to the enclosure. Core and coil shall be varnish impregnated and include a final wrap of insulating material to prevent exposure of bare conductors.
			3. Total leakage current to ground from windings shall not exceed the maximum values shown in Table 30.2 of UL 1047.
			4. The inherent regulation of the isolation transformer at rated input voltage shall be such that the difference between the output voltage at no load and the output voltage at rated current at unity power factor shall not exceed 3% of the output voltage at rated current per UL 1047.
			5. Transformer temperature rise shall be limited to 115° C above ambient at full load and shall not exceed the values indicated in Table 29.1 of UL 1047 when tested in accordance with UL 1047 Section 29.
			6. Transformer shall be manufactured using a Class (220)R UL Recognized insulation system, to thermally protect unit up 220° C.
			7. Transformer shall be mounted to the enclosure using vibration isolating washers. Maximum design sound level of installed system shall not exceed 35 dBA.
		5. Line Isolation Monitor (LIM)
			1. Line Isolation Monitor shall continuously monitor the impedance from each isolated conductor to ground and shall display the Total Hazard Current (THC) of the system. The LIM shall be capable of detecting all combinations of resistive and capacitive faults whether they are balanced, unbalanced or hybrid.
			2. LIM shall meet following performance specifications:
				1. Operating voltage 85 to 265 VAC (auto detecting)
				2. Operating frequency 50/60 Hz (auto detecting)
				3. Total Hazard Current (THC) range 0-5mA (user selectable for 0-2mA)
			3. LIM shall be Listed in accordance with UL Standard 1022 and CSA 22.2 No. 204.
			4. Normal status of the LIM shall be indicated by illumination of a green "Safe" LED. An alarm signal shall be obtained when the Total Hazard Current (THC) reaches a threshold value of not more than 5.0 milliamperes (mA). Alarm state is indicated by illumination of a red "Hazard" LED and by an audible alarm as well. A silence button shall be provided to mute the audible alarm without extinguishing the visual alarm indication. A yellow LED will remain on while LIM is in the silenced mode. The LIM shall automatically reset to normal status when the fault condition is corrected.
			5. LIM shall provide digital indication of the Isolated Power System’s THC in units of mA. Unit shall also include a bar graph type display of THC scaled from 0 to 160% of the LIM’s alarm point setting.
			6. A momentary test switch shall be provided on the face of the LIM for periodic manual testing/calibration of the unit, as well as verification that all indicators and meters are operational. In addition, LIM shall automatically initiate a regularly scheduled self-test/calibration sequence at least once per day. Frequency of self-test shall be configurable by user in increments of 1 to 24 hours.
			7. LIM shall contain a 2-Line (20 characters each row), high-contrast OLED user interface screen that clearly displays the unit’s current operating status, measured line-to-line voltage, present time, logged alarm data, and all user-configurable system settings.
			8. The LIM shall signal an alarm if it detects that its connection to the isolation panel’s reference ground bus is disconnected.
			9. The LIM shall include a wiring harness assembly for connection of compatible remote mounted alarm annunciator unit(s).
			10. In addition to driving optional remote annunciators, LIM shall include a SPDT relay contact for use with external alarm systems.
			11. The LIM shall include a multi-drop RS485 serial communication protocol for transferring system status and measurements data to compatible devices. Through the addition of an optional device network gateway, the LIM shall be capable of communicating with various Building Management System (BMS) supervisory software through Modbus TCP or BACnet protocols.
			12. The LIM shall be capable of integrating with optional system components when installed including: system load monitor, branch circuit load monitor, and fault location system.
			13. The PG LifeLink model SafeDetec shall be the basis for design.
		6. Circuit Breakers
			1. A main circuit breaker shall be provided on the primary line side of the isolation transformer. Breaker shall be 2-pole, thermal magnetic type, with minimum 10,000 AIC. Breaker shall be sized according to transformer voltage and kVA rating.
			2. All branch circuit breakers shall be factory installed based on specific quantities and ratings shown on project panel schedule(s). Branch circuit breakers shall be 2-pole, bolt-on type only, with thermal magnetic trip and minimum 10,000 AIC. Maximum 16 each per isolation transformer.
			3. All panelboard busbars shall be copper.
			4. Isolated Power Panel shall accommodate panelboards/breakers manufactured by Eaton, General Electric, Siemens, and Schneider Electric.

{Specifier: The following feature is optional. Delete section if not required}

* + 1. SYSTEM LOAD MONITORING
			1. Isolation Panels shall include a System Load Monitor (SLM) consisting of a current transformer (CT) and power supply that monitors the total load current of the isolation transformer. Load monitoring CT shall be connected to system’s Line Isolation Monitor which shall display the system’s present load as a percentage of total system capacity. A user-configurable pre-alarm value shall be set to alert staff of potential system overload ahead of primary main circuit breaker trip point.

{Specifier: The following feature is optional. Delete section if not required}

* + 1. BRANCH CIRCUIT LOAD MONITORING
			1. Isolation Panels shall include a Circuit Load Monitor (CLM) system, consisting of a set of Current Transformer Banks that monitor the load current of each branch circuit individually. Circuit monitoring CT banks shall be connected to system’s Line Isolation Monitor. User-configurable pre-alarm values shall be set to alert staff via the LIM display screen of potential branch circuit overloads ahead of circuit breaker trip points.

{Specifier: The following feature is optional. Delete section if not required}

* + 1. FAULT LOCATION SYSTEM
			1. Isolation Panels shall include a Fault Location System (FLS) that identifies the branch circuit on which an insulation fault is located. An elevated Total Hazard Current alarm on the LIM shall trigger the FLS to automatically scan each connected branch circuit and display the circuit number with the highest hazard current contribution. The FLS shall be connected to the LIM, which shall display the circuit number where fault is located.

{Specifier: The following feature is optional. Delete section if not required}

* + 1. REMOTE RECEPTACLE/GROUND MODULES
			1. Pre-wired Remote Receptacle/Ground Modules shall be supplied in quantities and locations in accordance with the project layout drawings. Modules shall have type 304 stainless steel front plates with a #4 brushed finish.
			2. All power receptacles shall be hospital grade type. NEMA configuration shall be according to layout drawings. Normal power shall be ivory, Emergency power shall be red.
			3. All ground jacks shall be hospital grade locking type, green, 30A. Each module shall include {Specify: qty.} each #10 AWG, flexible green equipment grounding cord assemblies for connection of mobile equipment. Cord assemblies shall be {Specify: length} inches in length and shall be terminated with an insulated alligator clip.
			4. PG LifeLink Model RRP shall be the basis for design

{Specifier: The following feature is optional. Delete section if not required}

* + 1. DEVICE NETWORK COMMUNICATION GATEWAY
			1. Isolation panel supplier shall include a Device Network Communication Gateway module(s) to manage enterprise RS485 serial network communications between all local IPS panels and shall include an uplink to the facility’s LAN network via Ethernet. The system shall be scalable and capable of aggregating multiple IPS sub-networks from various locations throughout the facility into a single interface accessible via web-browser.
			2. Communication module shall transmit status data from each IPS, including any optional systems to facility’s third-party Building Management System (BMS) via Modbus TCP fieldbus protocol. BMS software vendor is responsible for system integration.
			3. Communication module shall be capable of sending system notifications to designated personnel via email or SMS text.
			4. The PG LifeLink CGW-1208 shall be the basis for design.

{Specifier: The following Accessory is optional. Delete section if not required}

* + 1. REMOTE ANNUNCIATOR
			1. Where the layout drawings call for the isolated power panel to be installed outside of the operating room or patient care area being served, a remote annunciator shall be installed inside the room, or alternately at a continuously monitored area such as a nurse's station.
			2. Remote LIM signal annunciators shall be supplied as indicated on layout drawings. Remote annunciators shall be compatible with system Line Isolation Monitor and shall provide visual and audible indication of LIM alarm status. The PG LifeLink model DRA-1V shall be the basis for design.

{Specifier: Select one of the following three remote types as required, delete other types}

* + - * 1. Functions shall include: LED indicators for "SAFE" and "HAZARD" conditions, and audible alarm with local "SILENCE" button. PG LifeLink Model DRA-1 shall be basis for design.
				2. Functions shall include: LED indicators for "SAFE" and "HAZARD" conditions, audible alarm with global "SILENCE" button, digital display of Total Hazard Current (THC) with bar graph, and remote “TEST” button to manual test/calibrate LIM from remote location. PG LifeLink Model DRA-1V shall be basis for design.
				3. Functions shall include: LED indicators for "SAFE" and "HAZARD" conditions, audible alarm with global "SILENCE" button, digital display of Total Hazard Current (THC) with bar graph, remote “TEST” button to manual test/calibrate LIM from remote location, and an LCD user interface that remotely displays all other system parameters and logged data. PG LifeLink Model DRA-VS shall be basis for design.

{Specifier: The following Accessory is optional. Delete section if not required}

* + 1. MASTER REMOTE ANNUNCIATOR MODULE
			1. A Master Remote Annunciator Module (MRAM) shall be installed at the designated nurses’ station to provide centralized monitoring of all installed IPS panels for a particular area. The module shall include a touch-screen user interface that displays the summary status of all connected IPS panels with on-demand access to view detailed status of each individual panel. Refer to contract drawings for quantity and location(s) of Master Remote Annunciator Module(s).
			2. The MRAM shall include a master Device Network Gateway (DNG) that connects to and manages the local PG LifeLink RS-485 serial device network. The MRAM shall also communicate with additional DNG modules via TCP/IP over the facility LAN for scalable monitoring of IPS panels in multiple areas.
			3. The following IPS parameters for each system shall be viewable from the Master Remote Annunciator Module:
				1. System Status (SAFE, HAZARD, SILENCED, etc.)
				2. Total Hazard Current
				3. Secondary line voltage
				4. Transformer Load % *(if SLM option is installed in IPS)*.
				5. Circuit number of located fault *(if FLS option is installed in IPS)*.
				6. Circuit number of branch overload pre-alarm *(if CLM option is installed in IPS)*.
			4. The backbox shall be flush-mounted and constructed of galvanized steel.
			5. The front trim shall be fabricated of type 304 stainless steel with a #4 brushed finish.
1. Installation
	1. ASSEMBLY
		1. Contractor shall review and follow all manufacturer’s recommendations for proper handling, mounting, assembly, and wiring of equipment.
	2. Wiring
		1. All energized branch circuit conductors of the isolated power system shall be stranded copper having a cross‑linked polyethylene insulation, or equivalent with a dielectric constant of 3.5 or less. Type XHHW-2, 90°C is suitable for this purpose. Each branch circuit conductor shall be color‑coded in accordance with NFPA 70 - National Electrical Code – Article 517.160. Isolated conductor L1 shall be orange and conductor L2 shall be brown. Each branch circuit conductor shall also contain a distinctive colored stripe (other than white, green, or gray) along the entire length of the wire.
		2. Equipment grounding conductors shall be installed with each branch circuit in accordance with bonding requirements found in NFPA 70 - National Electrical Code – Article 517. Equipment grounding conductors shall be insulated type and green in color.
		3. Wire pulling compound adversely affects the dielectric constant of conductor insulation and shall not be used when pulling the wire of the isolated power system. Use of dry talcum powder is permitted. No more than six wires in a ¾” conduit will be allowed.
		4. Minimize length of conductor runs to the greatest extent possible to decrease accumulated leakage current. With all branch circuit wiring installed, system must be capable of passing minimum wiring impedance test requirement per NFPA 99 Section 6.3.2.6.2 (2012 Edition).
	3. TEST AND CERTIFICATION
		1. Contractor shall include the cost of and make all arrangements for testing of installed Isolation Panels by a qualified factory technician provided by the manufacturer of isolation systems.
		2. Upon completion of the installation, the qualified factory technician shall inspect and test the equipment to verify that it is properly installed and operating as specified. All inspections and testing required by NFPA 99 Section 6.3.2.6 (2012 Edition) shall be performed.
		3. A field test report and written certification that the system was installed and operating properly shall be furnished. The factory technician shall also instruct the hospital personnel in the proper use and maintenance of the equipment.