Technical Publication
IN-1108R8

Installation

HF Series Generators

REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
0	APR 15, 2014	First edition.
1	DEC 04, 2014	Power Line Connection updated.
2	MAY 21, 2015	New interconnection cable for Push-buttons Control Console.
3	JUL 20, 2015	Dosemeter connection added and Detectors connection updated.
4	DEC 09, 2015	CTSC Touch Screen Console and new interconnection cable.
5	JAN 24, 2017	Warning Lamp connection and general updates.
6	JUL 09, 2018	Serial Interconnection Section updated.
7	DEC 11, 2019	New PC Interface Box, Serial Interconnection and System Locks sections updated.
8	MAR 09, 2020	Power Line Connection updated.

This Document is the English original version, edited and supplied by the manufacturer.

The Revision state of this Document is indicated in the code number shown at the bottom of this page.

ADVISORY SYMBOLS

The following advisory symbols will be used throughout this manual. Their application and meaning are described below.

DANGERS ADVISE OF CONDITIONS OR SITUATIONS THAT IF NOT HEEDED OR AVOIDED WILL CAUSE SERIOUS PERSONAL INJURY OR DEATH.

ADVISE OF CONDITIONS OR SITUATIONS THAT IF NOT HEEDED OR AVOIDED COULD CAUSE SERIOUS PERSONAL INJURY, OR CATASTROPHIC DAMAGE OF EQUIPMENT OR DATA.

Advise of conditions or situations that if not heeded or avoided could cause personal injury or damage to equipment or data.

Note ☞

Alert readers to pertinent facts and conditions. Notes represent information that is important to know but which do not necessarily relate to possible injury or damage to equipment.

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SECTION 1 INTRODUCTION

The Installation process depends on the Generator and System configuration. Installation must be performed in the order indicated along this document. Perform only the sections required to install this Generator.

1.1 TOOLS AND TEST EQUIPMENT

The following hand tools and products are required for the Installation:

- Standard service engineers tool kit.
- Electric drill motor and assorted bits.
- Silicone Insulating Grease (proofing compound).
- Alcohol cleaning agent.

The following test equipment is required for Configuration and Calibration:

- Digital Multimeter.
- Non-invasive kVp Meter.
- Digital mAs Meter.
- Calculator.

- Only for AEC purposes:
  - Sensitometer.
  - Densitometer.
  - Filtration based on the RQA5 standard (21 mm Al) for the Collimator Filter Holder (recommended for AEC/ABC calibration).
  - Copper Plates can be used Instead of Aluminum:
    2 units of 1 mm thickness,
    1 unit of 0.5 mm thickness,
    2 units of 0.2 mm thickness,
    1 unit of 0.1 mm thickness.
  - Acrylic Plastic Plates can be used Instead of Copper Plates:
    6 units of 5 cm. thickness,
    5 units of 1cm. thickness.

- Only for Tomo purposes:
  - Tomophantom tool.

- Only for Fluoro purposes:
  - Dosimeter, with R/min and mR/min meters and/or mGy/min and μGy/min meters.
  - Imaging Test Phantom tool.
  - Copper Plates: 2 units of 1 mm thickness,
    1 unit of 0.5 mm thickness,
    2 units of 0.2 mm thickness,
    1 unit of 0.1 mm thickness.

1.2 PRE-INSTALLATION CHECK

Prior to beginning installation, it is recommended to inspect the site and verify that the X-ray room complies with Pre-installation requirements, such as:

- Incoming Line.
- Main Switch and Safety Devices.
- Conduits.
- Space Requirements.

(*Refer to the Pre-Installation document.)*

1.3 GENERAL CAUTIONS

OPERATOR AND SERVICE MANUALS SHOULD BE CAREFULLY READ AND UNDERSTOOD BY SERVICE PERSONNEL BEFORE USING AND SERVICING THE EQUIPMENT, ESPECIALLY THE INSTRUCTIONS CONCERNING SAFETY, REGULATORY, DOSAGE AND RADIATION PROTECTION. KEEP THE MANUALS WITH THE EQUIPMENT AT ALL TIMES AND PERIODICALLY REVIEW THE OPERATING AND SAFETY INSTRUCTIONS.

MAKE SURE THAT THE MAIN STORAGE CAPACITORS OF THE HIGH VOLTAGE INVERTER DO NOT CONTAIN ANY RESIDUAL CHARGE. WAIT UNTIL THE LIGHT EMITTING DIODES ON THE CHARGE/DISCHARGE BOARD AND ON THE ROTOR CONTROLLER ARE OFF (APPROX. 3 MINUTES AFTER THE UNIT IS TURNED OFF).

ALWAYS HAVE THE "IPM DRIVER BOARD" CONNECTED IN THE GENERATOR PREVIOUS TO THE ACTIVATION OF THE MAINS POWER. IF THE "IPM DRIVER BOARD" IS NOT CONNECTED, IRREVERSIBLE DAMAGE WILL OCCUR TO THE IGBTS.

TO AVOID THE RISK OF ELECTRIC SHOCK, THIS EQUIPMENT MUST ONLY BE CONNECTED TO A SUPPLY MAINS WITH PROTECTIVE EARTH. DO NOT TOUCH ANY HEATSINK OF THE CIRCUIT BOARDS EVEN IF THE GENERATOR IS TURNED OFF. PREVIOUS TO DISASSEMBLE ANY BOARD, REMOVE ALL CONNECTORS PLUGGED TO IT.

THIS GENERATOR IS PERMANENTLY CONNECTED TO THE POWER LINE AND POWERED ON UNLESS THE SAFETY SWITCH INSTALLED IN THE ROOM ELECTRICAL CABINET IS OFF. WHEN THE GENERATOR IS POWERED, THE NEON LAMP (GREEN) LOCATED IN THE TRANSFORMER T2 (GENERATOR CABINET) IS ON.

INTERNAL PARTS OF THE GENERATOR (ALL FUSES, LINE CONTACTOR [K2], INPUT TRANSFORMER [T2] AND ON/OFF RELAY [K1]) ARE PERMANENTLY POWERED ON THROUGH POWER LINE EVEN IF THE GENERATOR IS OFF. BE SURE THAT THE SAFETY SWITCH IS OFF BEFORE HANDLING ANY INTERNAL PART OF THE EQUIPMENT.

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SECTION 2 UNPACKING, CABINET INSTALLATION AND POWER LINE CONNECTION

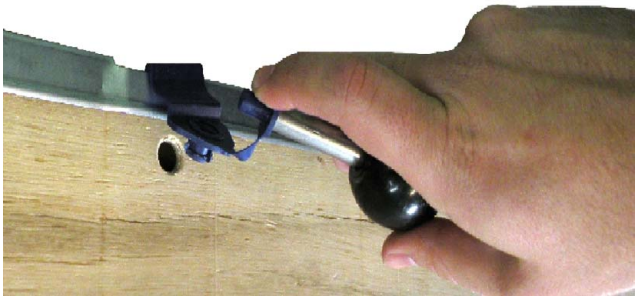
The Generator is shipped in one wooden shipping crate to facilitate transport and installation.

1. Upon receipt of the X-ray unit and associated equipment, inspect all shipping containers for signs of damage. If damage is found, immediately notify the carrier or agent.

Illustration 2-1
Shipping crate

2. Remove the upper plastic clips in order to remove the top of the shipping crate. Take out the Control Console (if present), Interconnection Cables, Manuals and other documentation and the rest of furnished parts. Do not discard any packing material such as envelopes, boxes or bags until all parts are accounted for as listed on the packing list.

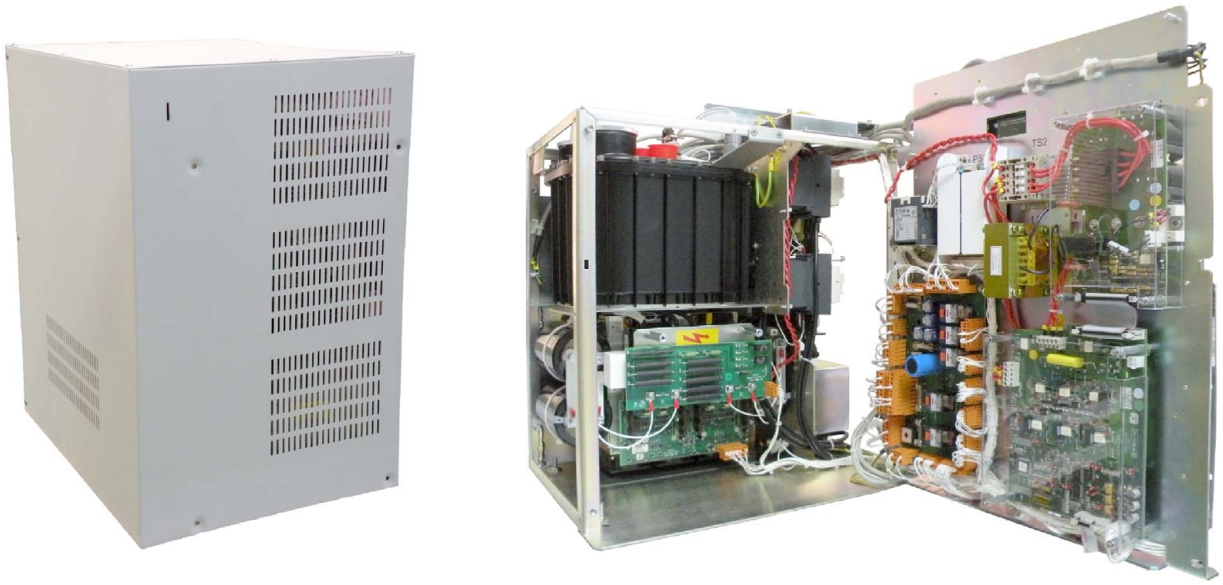
Illustration 2-2
Plastic clip removal



3. Remove the sides of the crate and take out the packing material from the pallet.

4. Remove the Generator covers *(refer to Section 2.1)*.

Illustration 2-3
SHFR Generator with and without covers



5. Remove the three screws M8 that secure the Generator cabinet to the rubber bushings mounted on the shipping pallet.

6. Remove the Generator Cabinet from the shipping pallet, placing it near its chosen room position.

CAUTION

This operation requires at least two people.

7. When the equipment is unpacked, verify that all items on the customer order are present, and the hardware and internal wiring is secure.

8. Check the part numbers/serial numbers of each component with their identification labels, and inspect all pieces for visible damage. If any damaged parts are found, repair or order replacements to prevent unnecessary delay in installation.

Note ☞ *The regulation certification as well as the final report and other documents related to the Generator are included together with the Service manual.*

2.1 COVERS DISASSEMBLY

The SHFR Generator covers consist of two parts joined by three rows of screws (two rows in the upper part and another one in the front).

To disassemble the covers, remove the eight lateral screws (four on each side) with an allen wrench. There is no need to remove the rest of the screws, as the two parts can be removed together.

Disconnect the internal ground wires before removing the covers.

Illustration 2-4
Internal ground wires

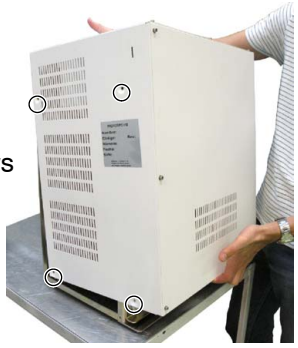
CAUTION

Remove the covers taking care not to pinch any cable. Take the same precautions when installing the covers back.

Optional handles can be used to easily remove and install the covers. The Generator covers have two specific slots, one on each side, to insert the handles as seen in the illustration below.

Illustration 2-5
Covers disassembly

Remove the lateral screws



Optional handles

CAUTION

Handles are only for covers removal and installation. Never use them to carry the Generator.

2.2 CABINET INSTALLATION

1. The Line Powered Generator Cabinet can be installed in one of the following ways:

   - **Using the optional Wall Support only.** (F*or installation refer to step 2.*)
   - **Using the optional Wall Support and Base Support.** (F*or installation refer to step 3.)*
   - **Freestanding** without supports. (F*or installation refer to step 6.)*

Note ☞ *Optional Supports must be requested in the customer order.*

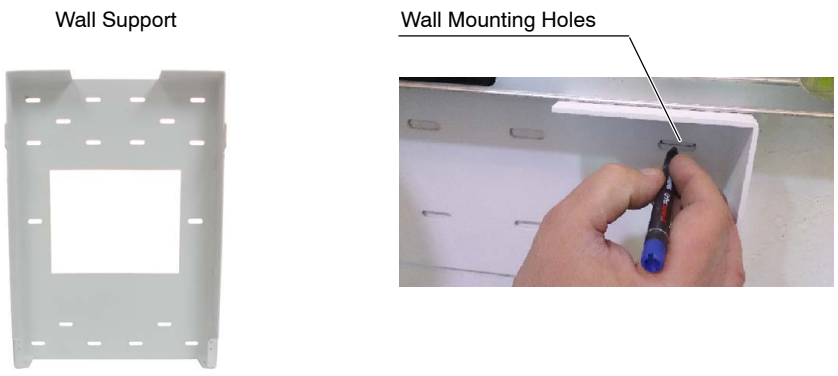
2. **Installation of the Generator Cabinet using a Wall Support Only.**

   An optional Wall Support can be provided to hang the Cabinet. The Wall Support must be securely installed on a resistant wall that can hold both the Generator and Cables (keep in mind their weights). (*Refer to the Pre-Installation document for more information.*)

   a. Place the Wall Support against the wall and level it.

   b. Mark the anchoring holes on the wall. Make sure that there is a sufficient number of anchoring points in order to firmly secure the Generator Cabinet to the wall (minimum 4/6 anchoring points).

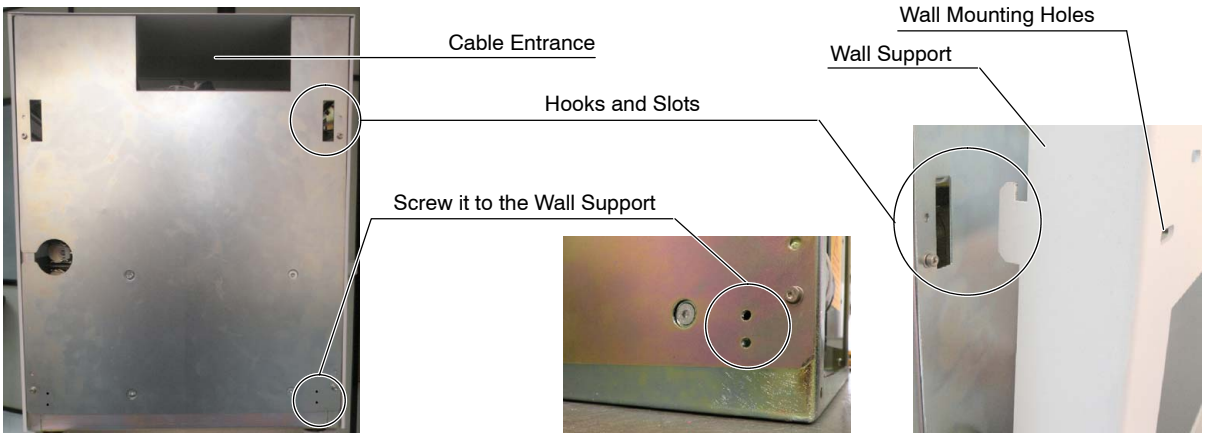
Illustration 2-6
Installation of the Wall Support (optional)



c. Secure the Support firmly to the wall.

d. Hang the Generator (at least two people are required) and screw it to the Wall Support (two screws on the left and two on the right).

Illustration 2-7
Installation of the Generator in the Wall Support (optional)



3. **Installation of the Generator Cabinet using a Wall Support and a Base Support.**

The Generator Cabinet can be assembled over a metallic Base Support (Cable Box) and a Wall Support at the rear side. The final assembly (Generator + Supports) can be hung on the wall (*refer to step 4.*) or left freestanding (*refer to step 5.*).

(*Refer to the Pre-Installation document for more information.*)

Illustration 2-8
Generator with optional Supports

4. *When hanging the Generator on the wall*, the Wall Support must be securely installed on a resistant wall that can hold the Generator with the Supports and Cables (keep in mind their weights). (*Refer to the Pre-Installation document for more information.*)

   a. Place the Wall Support against the wall and level it.

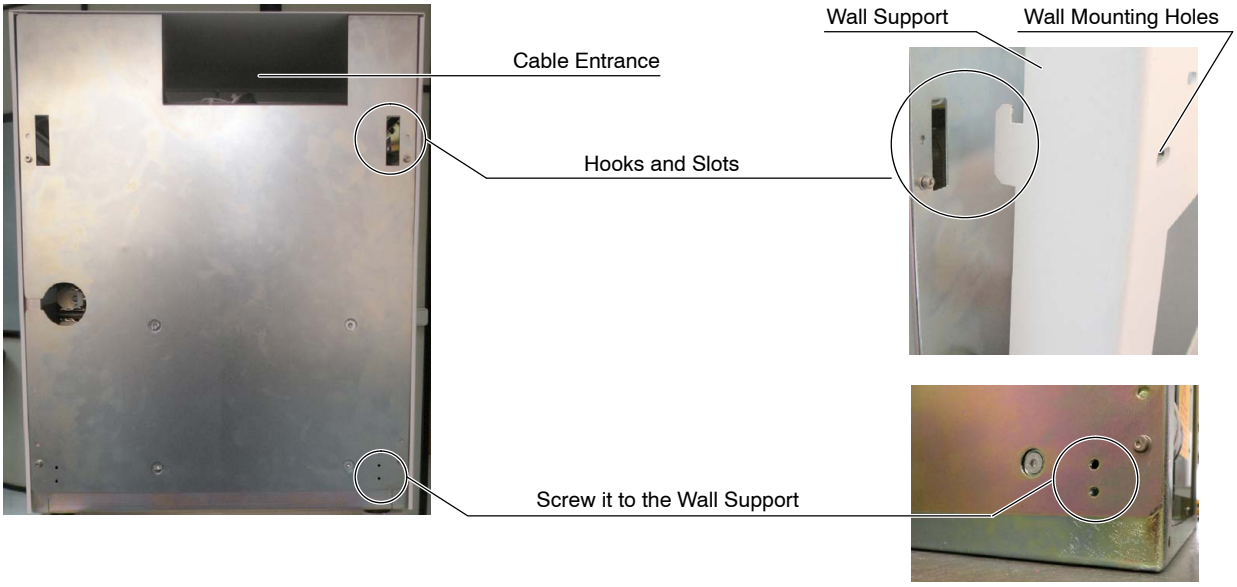
   b. Mark the anchoring holes on the wall. Make sure that there is a sufficient number of anchoring points in order to firmly secure the Generator Cabinet to the wall (minimum 4/6 anchoring points).

Illustration 2-9
Installation of the Wall Support (optional)

   c. Assemble the Wall Support to the Base Support using two M6x20 screws (supplied).

   d. Secure firmly the Wall Support and Base Support assembly to the wall.

Illustration 2-10
Installation of the Generator in the Wall Support (optional)



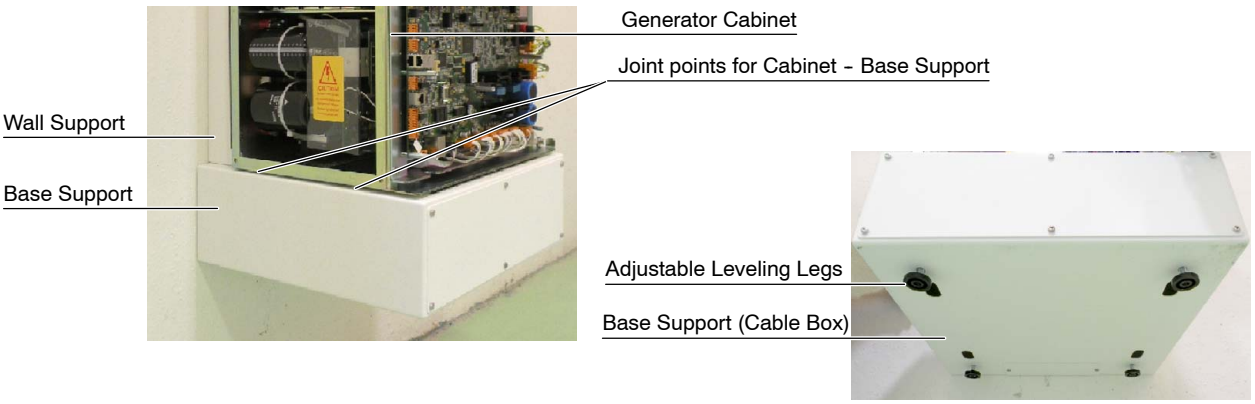
e. Remove the four Adjustable Leveling Legs from the base of the Generator Cabinet and re-install them in the Base Support.

f. Hang the Generator (at least two people are required) and screw it to the Wall Support (two screws on the left and two on the right).

g. Secure the Generator Cabinet to the Base Support using four M6x20 screws (supplied).

h. Go to step 7.

Illustration 2-11
Installation of the Base Support (optional)



5. *When the Generator is freestanding*, perform the following steps:

a. Remove the four Adjustable Leveling Legs from the Base of the Generator Cabinet and re-install them in the Base Support.

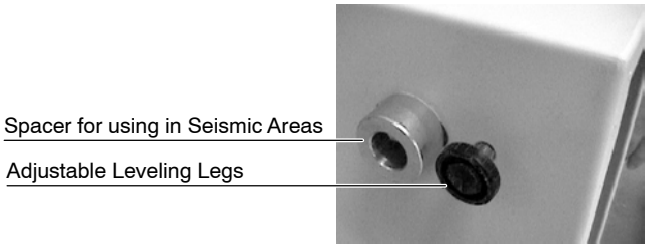
b. Place the Base Support near its chosen place in the room. Level the Base using the Adjustable Leveling Legs. Keep the Base at the maximum distance from the floor.

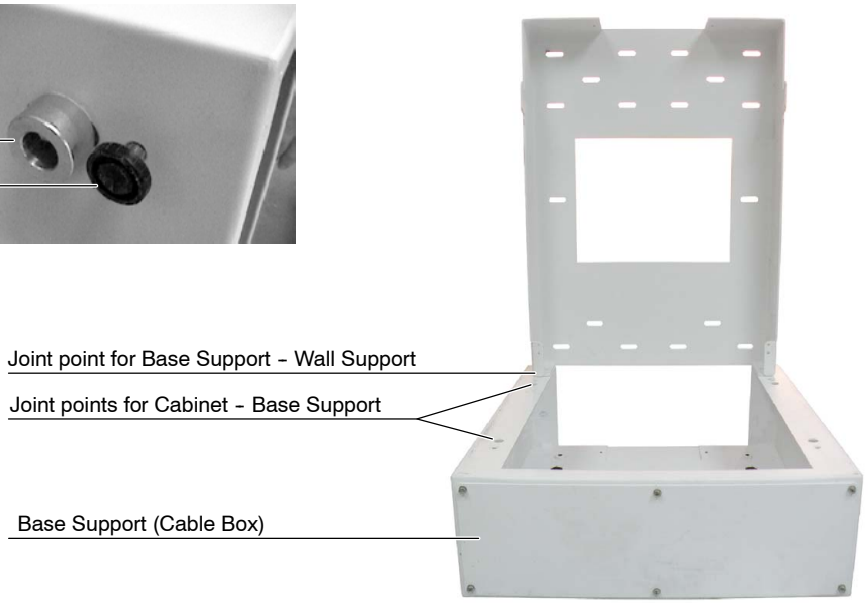
Seismic areas and other conditions require the Generator to be secured to the floor. There are mounting holes on the bottom of the Base Support. Place the four spacers (provided) under the Base and secure them to the floor. Keep the four Leveling Legs at the same height as the spacers. *(Refer to Illustration 2-12.)*

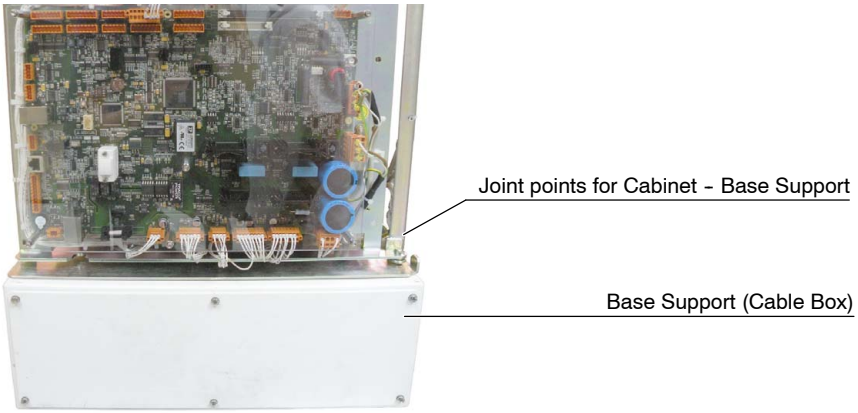
c. Assemble the Wall Support to the Base Support using two M6x20 screws (supplied). Place the Generator Cabinet on top of the Base Support, secure it to the Base Support using four M6x20 screws (supplied) and screw it to the Wall Support (two screws on the left and two on the right). At least two people are required for this operation. *(Refer to Illustration 2-12.)*

d. Go to step 7.

Illustration 2-12
Installation of the Generator over the Base Support (optional)





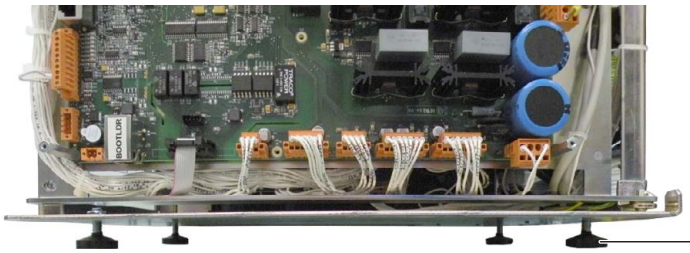


6. **Installation of the Generator Cabinet Freestanding.**

   Usually, the Generator Cabinet is freestanding. Place the Cabinet near its chosen place in the room. Level it using the Adjustable Leveling Legs at the bottom of the Cabinet. Keep the Base at the maximum distance from the floor.

   Seismic areas and other conditions require the Generator to be secured to the floor. There are mounting holes on the bottom of the Cabinet. Keep the four Leveling Legs at the same height. (R*efer to Illustration 2-13.*)

Illustration 2-13
Adjustable Leveling Legs



7. Leave a sufficient working area around the equipment that will permit unhindered movements until its final assembly.

2.3 POWER LINE CONNECTION

KEEP IN MIND THE GENERAL CAUTIONS INDICATED IN SECTION 1.3.

DO NOT POWER ON THE GENERATOR UNTIL SPECIFICALLY INSTRUCTED IN THIS SERVICE MANUAL.

1. Verify that the power supply line is "*OFF*" in the Room Electrical Cabinet. Verify that the power line to the Generator is cut when the Emergency Switch(es) is(are) activated.

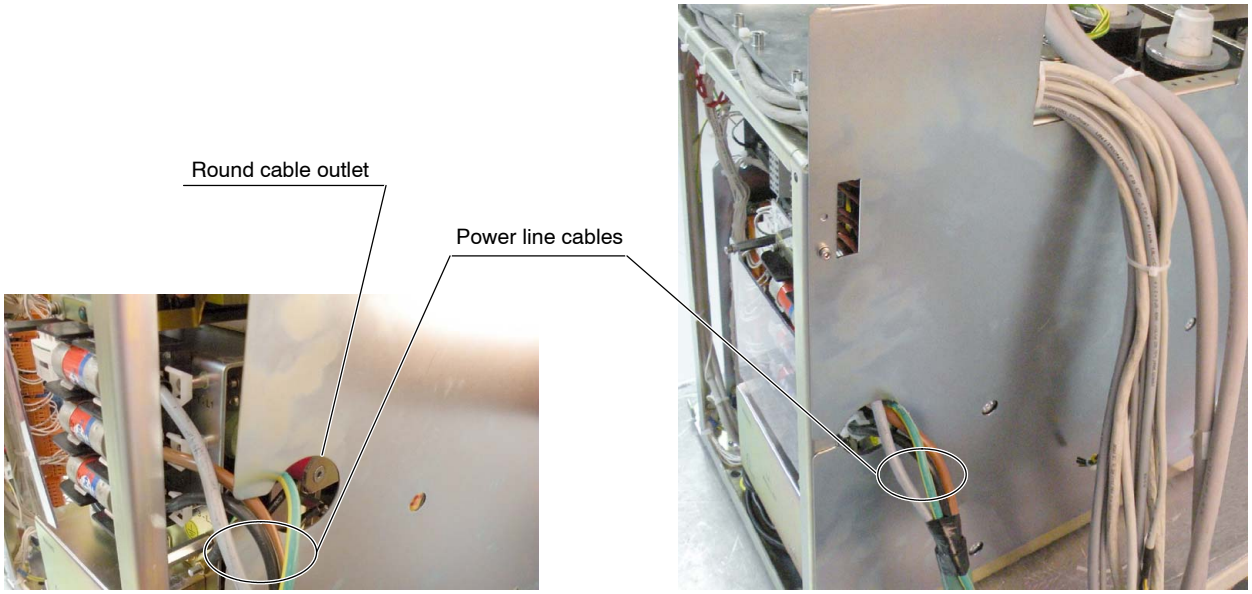
2. The power supply line should conform with the Generator model defined in the "*Pre-Installation*" document. Wire sizes indicated in this document are relative to the power supply line and wire length. Verify that the power line voltage and phase of the Generator coincides with the one for Room Electrical Cabinet.

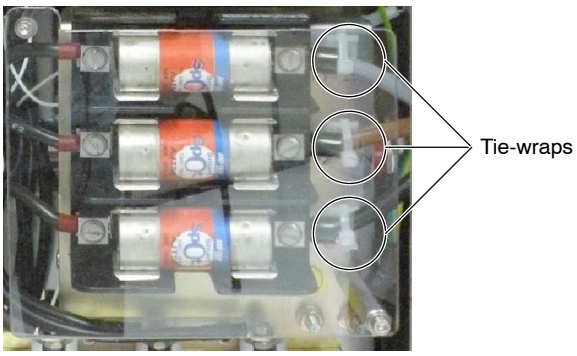
3. Cut the cables to the appropriate length and remove insulation from both ends of the power and ground wires. Connect them to the respective terminals in the Room Electrical Cabinet.

4. Route the Power Line Cables to the Ground Terminal and Input Line Fuses through the Round Cable Outlet on the Rear Cover of the Cabinet (always apply Local Codes for cable routing). To do so, unscrew the Rear Cover, connect the cables to their respective terminals and secure them using tie-wraps.

   These cables can also be secured to the Fastening Bar of the Cabinet and routed internally along the rear side of the Cabinet when installing the Generator using a Wall support.

Illustration 2-14
Cable routing





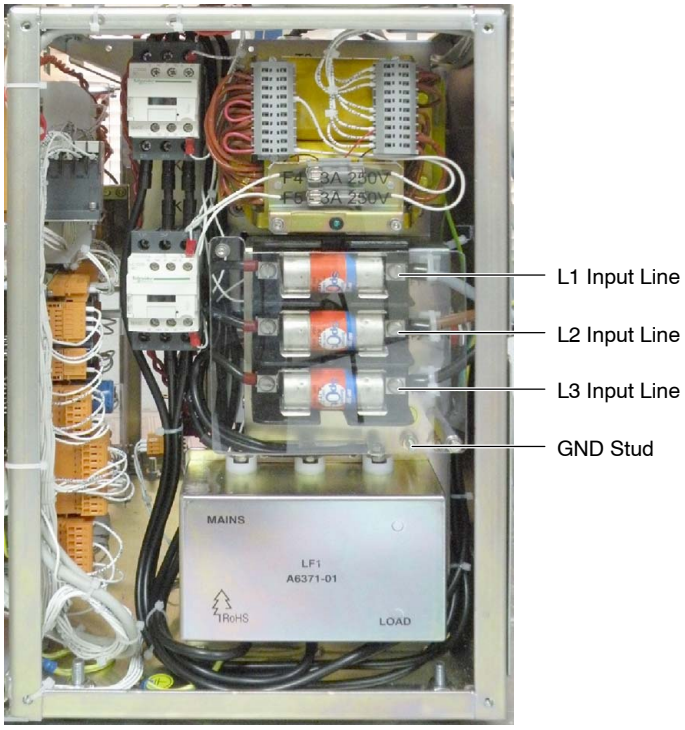
5. For Single Phase Generators, connect the Power wires L1 and N (L2) to the Fuse Holders of F1 and F2 (right side of the Cabinet), and the Ground wire to the Ground stud in the Cabinet Frame.

WARNING

SINGLE PHASE GENERATORS ARE FACTORY DELIVERED TO OPERATE ON PHASE AND NEUTRAL. IN CASE OF CONNECTING THE EQUIPMENT TO A TWO-PHASE LINE, REPLACE THE NEUTRAL CARTRIDGE WITH THE FUSE SUPPLIED WITH THE GENERATOR.

6. For Three Phase Generators, connect the Power wires L1, L2 and L3 to the Fuse Holders of F1, F2 and F3 (right side of the Cabinet), and the Ground wire to the Ground Stud in the Cabinet Frame. Three Phase Generators do not need Neutral (N) wire connection from the Line.

Illustration 2-15
Power Line connections

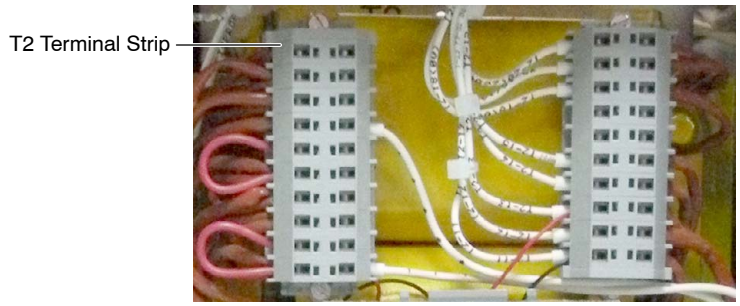


7. Place the Rear Cover back, passing the cables through the Cable Outlet slot. Finally, screw the cover. *(Refer to Illustration 2-14.*)

8. According to the **nominal voltage** of the line, verify or connect the wire "⁎" to the indicated terminal (TB) of Transformer T2. This wire is factory connected to 230 V~ (for 1-Phase) or to 208V~, 230 V~, 400 V~ or 480 V~ (for 3-Phase Generators in accordance with the Generator configuration). (*Refer to Schematic 54302260*).

Note ☞ *For 220 V~ power line, connect the wire "⁎" to the 230 V~ terminals.*
For 380 V~ power line, connect the wire "⁎" to the 400 V~ terminals.

Illustration 2-16
Connections on Transformer T2



9. After connecting the Power Line Cables, secure them to the Fastening Bar using cable ties if they are routed over the Fastening Bar, or using a suitable clamp if they are routed through the Round Cable Outlet on the Rear Cover of the Cabinet (always apply Local Codes).

10. Install the Control Console as indicated in *Section 2.5.*

2.4 ON/OFF BOX CONTROL PANEL INSTALLATION

The ON/OFF Box is shipped with the Handswitch, Generator and PC cables already connected. The PC cable can have either a USB connector or two DB9 connectors, depending on the option required. In this last case, it is mandatory to install the A3179-XX Auto ON/OFF board in the computer, to which one of the DB9 connectors has to be connected.

The Handswitch support and the optional sloping support are shipped in a separate box.

Illustration 2-17
ON/OFF Box and Handswitch support

ON/OFF Box

Handswitch Support

The ON/OFF Box can be either wall mounted or freestanding on a table. For the wall mounting option the Handswitch support is mandatory, otherwise it is optional, but recommended.

For wall mounting, it is recommended to install only the Handswitch support in order to place the Handswitch in vertical position.

On the contrary, if the ON/OFF Box is going to be used freestanding on a table, it is recommended to install also the sloping support in order to place the Handswitch with the necessary inclination to avoid it from slipping out of the support.

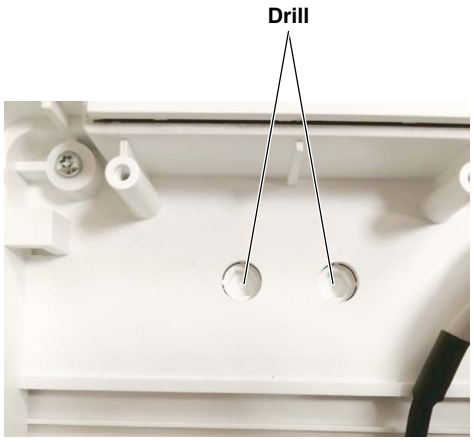
1. Handswitch support installation:

   a. Unscrew both screws from the bottom cover and put it aside.

Illustration 2-18
Bottom cover

   b. Drill two holes for the Handswitch support nuts and screws using a 3.5 mm (9/64”) drill bit.

Illustration 2-19
Drilling points

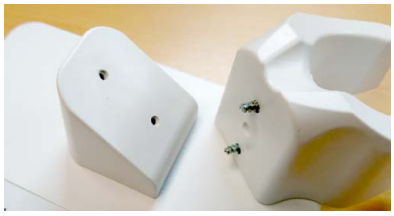


- To install only the Handswitch support, place two nuts (M3) in the inner hexagonal spaces and screw the Handswitch support from the outer part of the ON/OFF Box using two M3x10 screws.

Illustration 2-20
Handswitch support

- To install the Handswitch support with the sloping support, screw the sloping support from the inner part of the ON/OFF Box and, then, screw the Handswitch support to it. Use four ∅ 3x10 screws for plastic.

Illustration 2-21
Handswitch support with sloping support



2. ON/OFF Box installation.

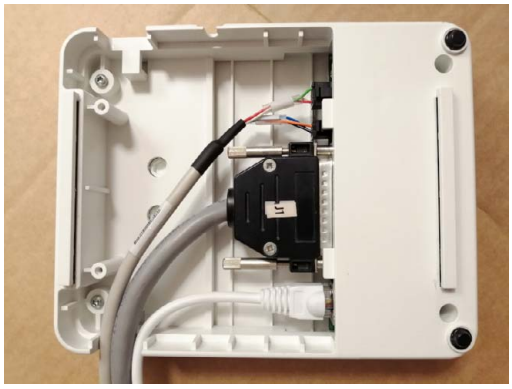
- Freestanding: Reinstall the bottom cover using the previously removed screws and place the ON/OFF Box in its final position.

Illustration 2-22
Freestanding installation

- Wall mounting:

a. For wall mounting, the bottom cover is discarded, so it is possible to switch the cables position from the top cable outlet to the bottom cable outlet. In that case, cut the tie-wrap that hold the cables, route them through the opposite outlet and hold them together and to the ON/OFF Box with a new tie-wrap.

Illustration 2-23
Cables outlet



b. Fix the Wall support to the wall using 4 anchor screws.

c. Slide the ON/OFF Box into the Wall support, taking care that it fits in both tracks, and secure it to the support with a screw on the top.

Illustration 2-24
Wall support

Illustration 2-25
Wall mounting installation

3. Proceed with the cable connections *(refer to Section 3.4.1 and to the Schematics document for cable connections).*

2.5 CONTROL CONSOLE INSTALLATION

Depending on the configuration of the System, the Generator may be provided with the ATBC-RAD push-buttons Control Console or with the touch screen console CTSC.

2.5.1 PUSH-BUTTONS CONTROL CONSOLE

1. Control Console can be freestanding, wall supported or mounted on an optional Pedestal. Console is provided with several mounting holes on the bottom for anchoring to the Pedestal or another support.

2. When a Pedestal is used, secure the Pedestal to the floor through the anchoring holes on its base and place the base cover. Attach the Console to the Pedestal using the mounting holes on the bottom of the Console.

3. When the Console is wall supported, secure the support to the wall and attach the Console to the support using the mounting holes on the bottom of the Console.

4. Leave a sufficient working area around the equipment until its final assembly.

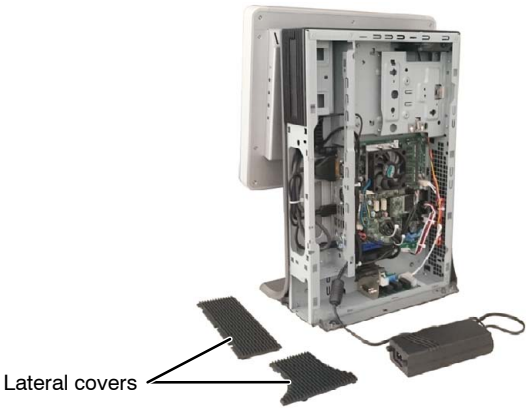
5. Cables can enter into the Generator through the Cable Outlet on the upper side of the Wall Support or through the Cable Outlet at the rear side of the Base Support (according to the raceway position in the room and Local Codes). The non used Cable Outlet has to be closed with the cover supplied. (*Refer to Illustration 3-2.*)

2.5.2 TOUCH SCREEN CONSOLE CTSC

This console is freestanding and it contains the Power Supply inside. Power Cable and ON/OFF Kit, that comprises the PC Interface Box and the communication cables, are also supplied with the Touch Screen Console.

1. Remove the back cover of the PC. Follow the instructions of the label of the cover.
   a. Push the switch to the unlock position to release the cable cover.
   b. Push the release latch.
   c. Slide the back cover upwards to remove.
2. Extract the Power Supply (AC/DC Adapter).
3. Remove both back covers as indicated by label of inside cover.

4. Remove both lateral covers to facilitate the access to the connectors and allow the fixation of the cables.



5. Proceed with the cable connections before mounting back the Console covers *(refer to Section 3.4.1 and to the Schematics document for cable connections).*

6. Mount back all covers of the Touch Screen Console. The Power Supply can be mounted inside the Console or placed outside as desired.

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SECTION 3 CABLE CONNECTIONS

This section provides the information necessary to connect the Generator Cables with the system and options.

Note ☞ *For more information about electrical requirements and cable connections, refer to the Pre-Installation document and to the Schematics document for the system interconnection maps.*

Some safety devices such as the Safety Switch/Emergency Switch, Warning Light, and Door Interlock Switch are supplied and installed by the customer. Verify that safety devices have been properly installed and routed during the Pre-Installation procedure.

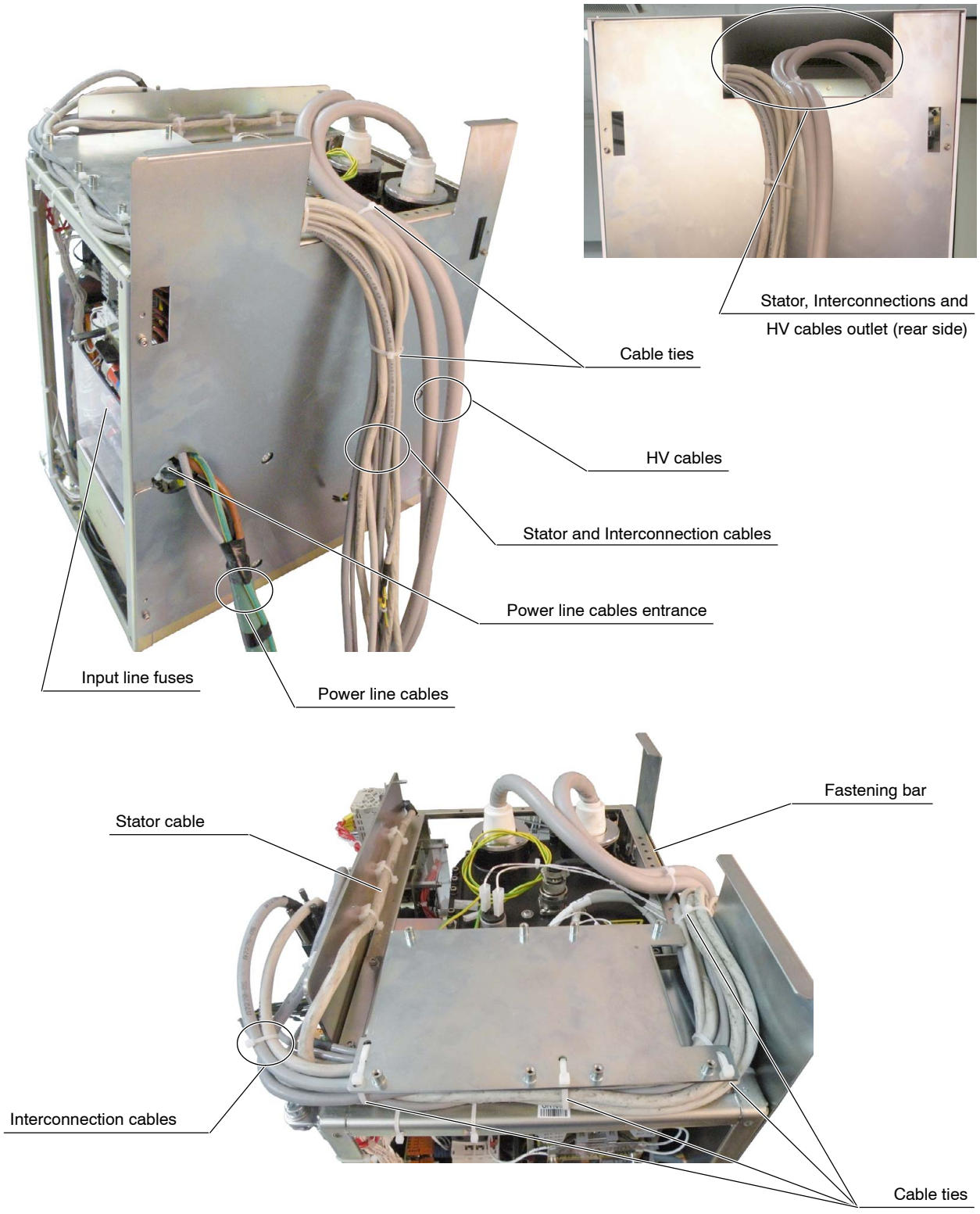
3.1 CABLE ROUTING INSIDE GENERATOR CABINET

3.1.1 GENERAL CABLE ROUTING

1. Before connecting the Interconnection cables within the Generator Cabinet, cables must be first connected to each Device (Tables, Buckys, etc.) and routed through the raceways. Remove the ferrite blocks of the cables (factory clamped) when it is required to carry out a correct routing, then re-install the ferrite blocks where they originally were around cables.

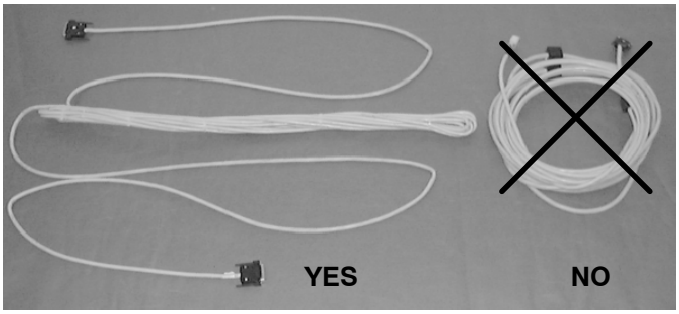
2. Inside the Generator Cabinet, all Interconnection cables must be routed over the Fastening Bar (upper rear bar) of the Cabinet Frame minding the upper Cable Outlet at the rear side of the Cabinet Cover. (*Refer to Illustration 3-1.*)

Illustration 3-1
Cable routing



CAUTION

In order to avoid signal interferences, it is strongly recommended to fold and fasten close to the Generator Cabinet the portion of cables not routed (see picture below). Never wrap in circles.



3. Connect all cables as indicated in the present Section.

4. Secure all cables to the Fastening Bar using cable ties after all cable/wire connections are complete.

3.1.2 LINE POWERED GENERATOR WITH OPTIONAL SUPPORTS

1. Before connecting the Interconnection cables within the Generator Cabinet, cables must be first connected to each Device (Tables, Buckys, etc.) and routed through the raceways. Remove the ferrite blocks of the cables (factory clamped) when it is required to carry out a correct routing, then re-install the ferrite blocks where they originally were around cables.

2. Cables can enter into the Generator through the Cable Outlet on the upper side of the Wall Support or through the Cable Outlet at the rear side of the Base Support (according to the raceway position in the room and Local Codes). The non used Cable Outlet has to be closed with the cover supplied. (*Refer to Illustration 3-2.*)

3. Route each cable through the Base Support and take out each one to fold and fasten individually the remaining portion of cable that is not used for Generator connections. Then, route the other end of the cable through both Supports. (*Refer to Illustration 3-2.*)

4. Inside the Generator Cabinet, all Interconnection cables must be routed over the Fastening Bar (upper rear bar) of the Cabinet Frame minding the upper Cable Outlet at the rear side of the Cabinet Cover. (*Refer to Illustration 3-1.*)

5. Guide the Stator and Interconnection cables through the right side of the Fastening Bar under the upper metal sheet, tightening them to the upper metal sheet using zip ties.

6. The Stator cable must be routed through the rear side of the front door.

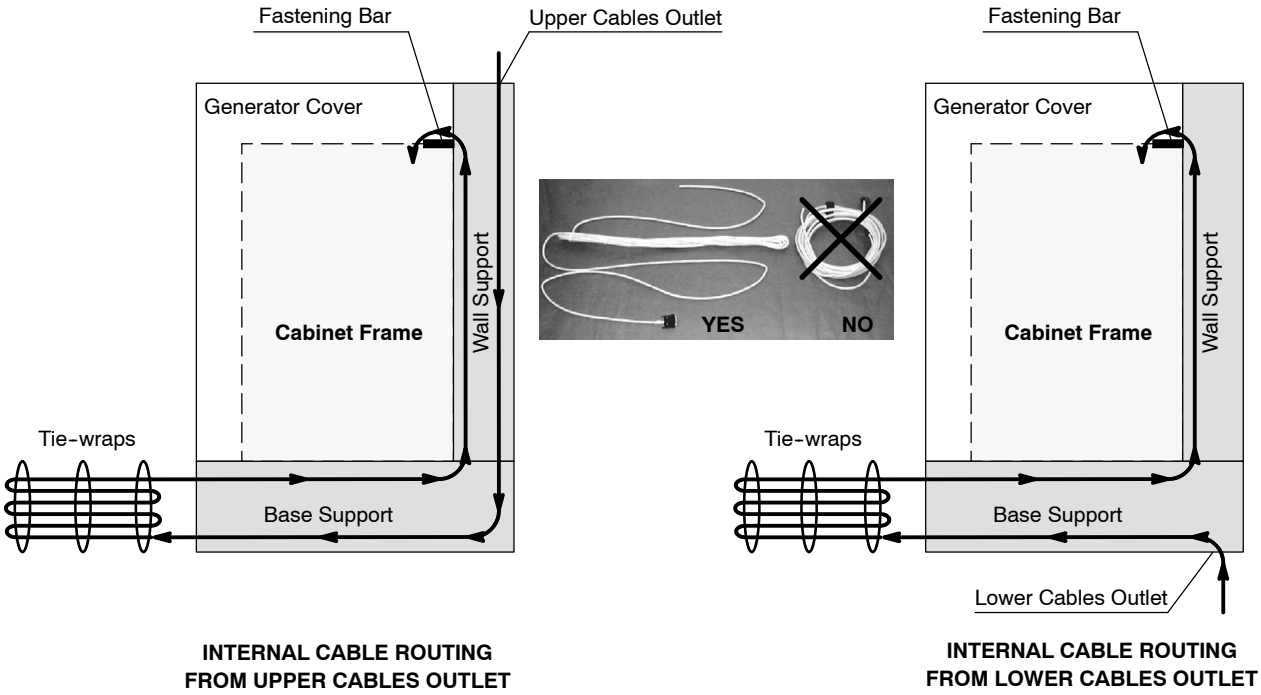
7. All the folded cables should be put into the Base Support. Install the Front Cover of the Base Support.

In order to avoid signal interferences, it is strongly recommended to fold and fasten the remaining portion of cables as indicated in Illustration 3-2, before putting them inside the Base Support. Never wrap them in circles.

8. Connect all cables as indicated in the present Section.

9. Secure all cables to the Fastening Bar using cable ties after all cable/wire connections are complete.

Illustration 3-2
Cable routing and outlets

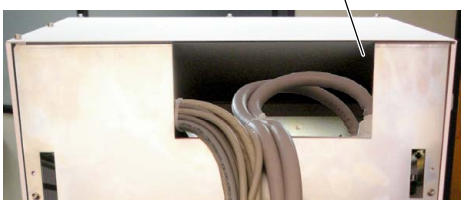


INTERNAL CABLE ROUTING FROM UPPER CABLES OUTLET

INTERNAL CABLE ROUTING FROM LOWER CABLES OUTLET

Cables routing from Cabinet to Base support (rear view)

Cables outlet (rear side of the Cabinet cover)



3.2 HIGH VOLTAGE CABLES CONNECTION

Connect the HV Cables in the HV Transformer (Generator).

These cables must enter into the Generator through the cable outlet on the upper side of the Cabinet and then attached to the fastening bar (upper rear bar) of the Cabinet frame minding the upper cable outlet at the rear side of the Cabinet cover.

CAUTION

The Terminal Pins of the High Voltage cables are extremely delicate and easily damaged. Therefore they must be handled carefully. Make sure that they are straight and that the splits in the pins are open (parallel to sides).

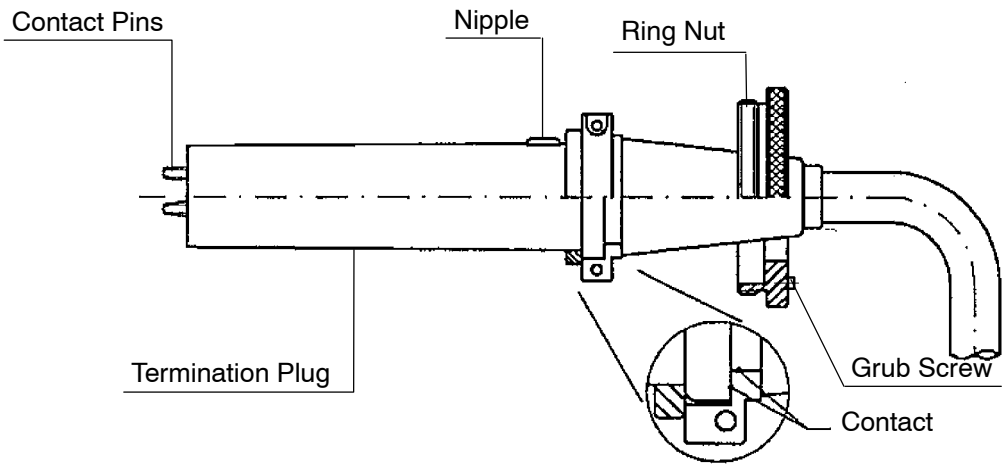
Anode and Cathode cables are furnished according to the room layout (length of the cables).

1. The mounting accessories of each termination plug are factory assembled. For extended information refer to the HV Cable manufacturer's instructions located inside the HV Cable package.

CAUTION

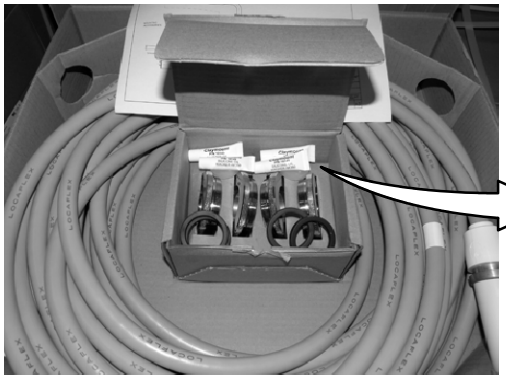
Do not install the Silicone washer supplied with the HV Cables.

2. Unscrew the grub screw of the ring nut. (Refer to the illustration below.)



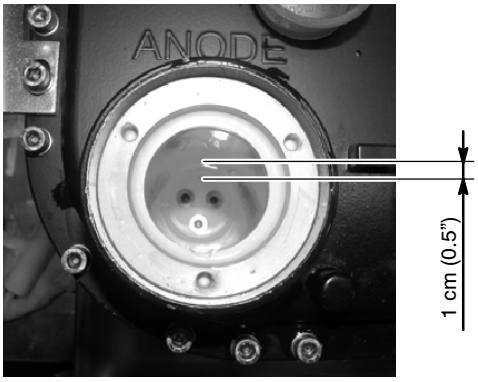
3. Prepare the High Voltage terminals that will be installed in the HV Transformer.

   - Put approximately 1 cm (0.5”) of HV Silicone Oil in the HV Transformer receptacles (included in the HV Cables package).



HV Cables Package

HV Silicone Oil



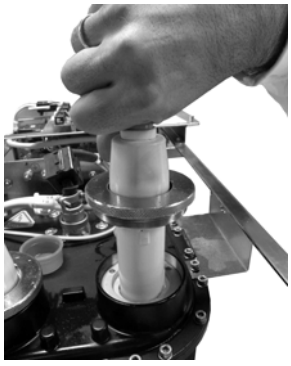
HV Transformer Receptacle

   - If HV Silicone Oil is not available, fill the receptacles using silicone paste provided with the X-ray Tube.

HV Silicone Paste

HV Cable Terminal with Silicone Paste

4. Carefully insert the Anode and Cathode termination plug into the respective receptacle socket (watch the nipple on the plug to ensure correct positioning of the contact pins).



5. Hand tighten the ring nut. It must be secure. Tighten the grub screw.

6. Prepare the High Voltage terminals that will be installed in the X-ray Tube(s) receptacles as previously described. Apply Silicone Paste over the entire surface of the Plug including the Pins.

7. Carefully connect the Anode and Cathode cables from the HV Transformer to the respective X-ray Tube(s) receptacles. Ensure that all connections are made correctly, maintaining correct Anode and Cathode orientation.

8. Hand tighten the ring nut. It must be secure. Tighten the grub screw.

3.3 X-RAY TUBE CONNECTION

3.3.1 STATOR CABLE

X-ray Tubes are equipped with the Stator cable installed.

Route the Stator cable together with the HV cables to the Generator Cabinet. Connect the Stator cable terminals to the indicated Terminal Block TS1:

STATOR WIRES	TERMINAL TS1
MAIN	TS1-1
AUX (Shift)	TS1-2
COMMON	TS1-3

MAKE SURE THAT STATOR WIRES ARE PROPERLY CONNECTED. BEFORE MAKING ANY EXPOSURE, CHECK THAT THE ANODE ROTATES CORRECTLY.

FOR SAFETY REASONS (TO AVOID ELECTRIC SHOCKS), THE STATOR CABLE MUST BE SHIELDED AND BOTH ENDS OF THE SHIELD MUST BE CONNECTED TO GROUND.

THERMOSTAT OR PRESSURE SWITCH SIGNAL

If the X-ray Tube is provided with a Safety Thermostat (approx. 65 ºC) or Pressure Switch (must be NC Contact), the two wires should be routed to the Terminal Block TS1 in the Generator Cabinet and connected to the following Terminals.

In case that the X-ray Tube is provided with a Safety Thermostat (approx. 65 ºC) and a Pressure Switch (both must be NC Contacts), connect them in series before routing, connecting both wire-ends to their respective Terminals in TS1.

THERMOSTAT WIRES	TERMINAL TS1
GND	TS1-4
THERMOSTAT T1	TS1-5

If a X-ray Tube is not provided with Thermostat signal, jump both connections in the Terminal Block TS1 (*refer to above table).*

FANS

Wires from fans should be routed with the Stator Cables, and connected to the indicated terminal of the Generator Cabinet. Depending on the model of X-ray Tube, the fans are powered at 120 V~ or 230 V~. Make the following connections to select the fan voltage.

Connect wires from fans to:

0 V~	120 V~	230 V~
TS1-8	TS1-7	TS1-6

GND AND/OR SHIELD

Connect the GND and/or Shield wire of the Stator cables to:

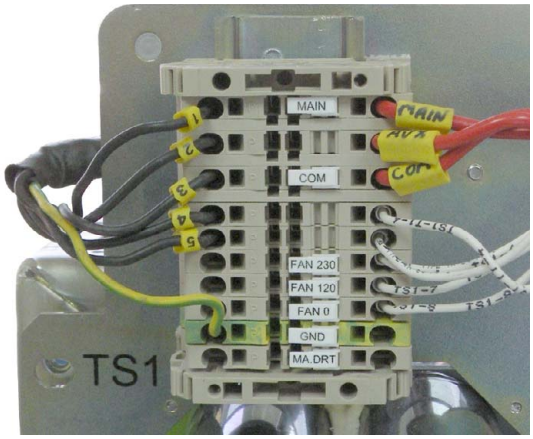
GND WIRE	TERMINAL TS1
GND and/or Shield	TS1-9

3.3.2 X-RAY TUBES WITH METALLIC INSERT ENVELOPE

In case of X-ray Tubes with a Metallic Insert Envelope, it is required to connect the wire from the Metallic Insert Envelope to the Terminal Block TS1-10 on the Generator. *(Refer to Illustration 3-3.)*

Also, verify that TS1-10 is connected to J18.5 of the A3640-XX Control board *(refer to schematic 54302260 in the Schematics document).*

Illustration 3-3
Terminal Block TS1



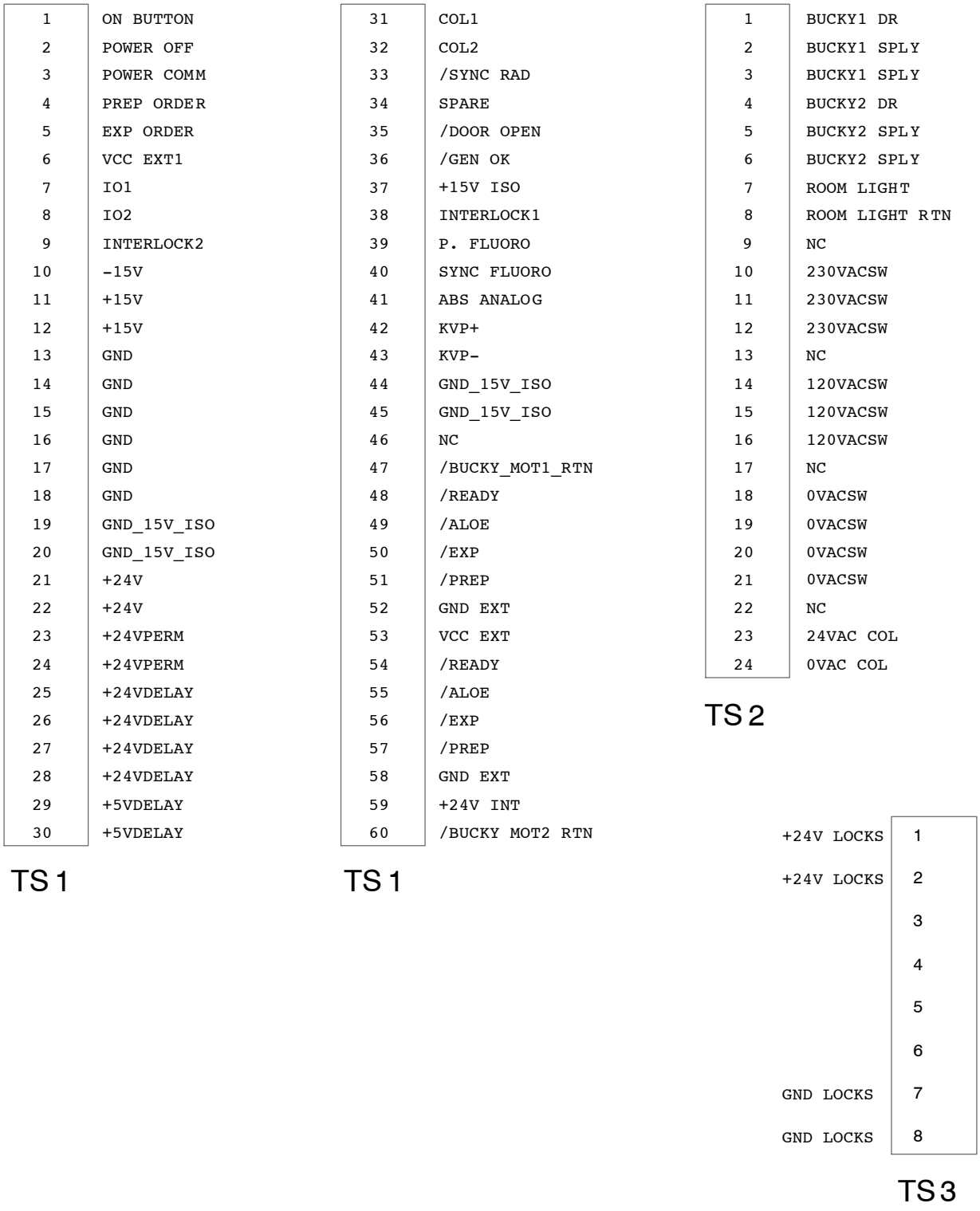
3.4 INTERCONNECTION CABLES

This section identifies the cables and runs needed for Generator and System Interconnection. Route and connect the interconnection cables from each component installed in the system to the Interface board as indicated in *Illustration 3-4.*

CAUTION

Interconnection cables should not be routed into the same conduit or cable raceway as the Power or High Voltage cables.

Illustration 3-4
Interface board TS1, TS2 and TS3 connections



3.4.1 SERIAL INTERCONNECTION RS232/RS422/RS485

PUSH-BUTTONS CONTROL CONSOLE

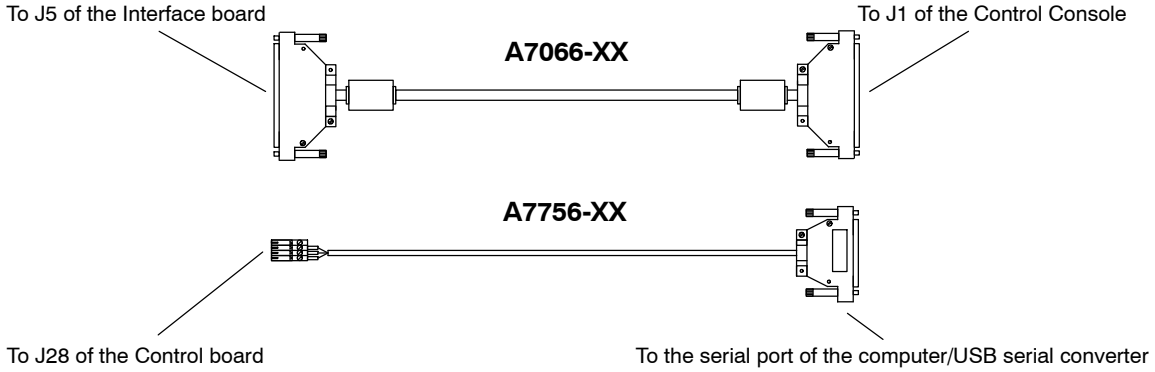
To connect only the Control Console to the Generator, just the serial interconnection cable A7066-xx is needed.

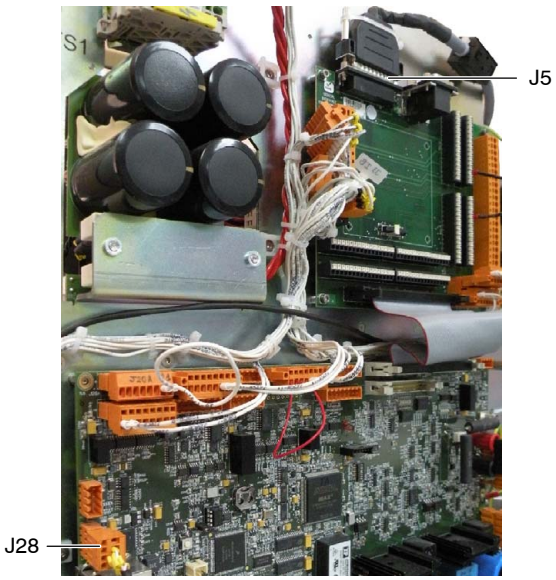
To allow simultaneous connection of the Control Console and a PC to the Generator for configuration and calibration purposes, connect the Interconnection Cable A7756-xx from J28 of the Control board to the serial port of the computer and the Interconnection Cable A7066-xx from J5 of the Interface board to J1 of the Control Console.

CAUTION

Only use the Interconnection Cable A7756-XX for technical service. Do not connect it to the serial port of the back of the Control Console or damage could occur to the Console.

Illustration 3-5
Interconnection cables connections





For computers without serial port, use a USB serial converter to allow the connection of the Interconnection Cable A7756-xx to a USB port of the computer (if needed, contact the Generator manufacturer to get an optional USB serial converter, P/N SAT-51213018, compatible with the Generator). Make sure to have the USB serial converter drivers installed in the computer before connecting it (refer to the USB serial converter manufaturer's instructions).

When connecting the USB serial converter to the computer, the operating system selects a random COM port, which has to be changed in order to allow the correct operation of the Tube's downloader. To do so, go to "Control Panel > Device Manager" (or "Control Panel > System > Hardware > Device Manager", for Windows XP). Right click on the device and click on "Properties". Click on "Port Settings" and then, click on "Advanced…". Click on the "COM Port Number" to display the dropdown menu and select one of the following COM ports: COM1, COM2, COM3, COM6, COM7 or COM8.

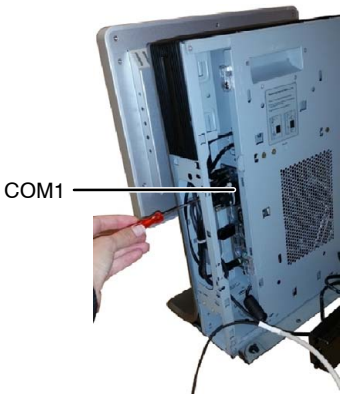
Once the Configuration and Calibration procedures are completed, disconnect the USB serial converter from the computer (if used) and then, the RS232 end of the Interconnection Cable A7756-xx and isolate it.

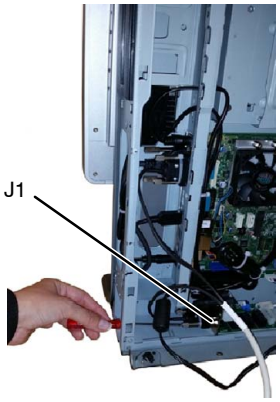
CTSC TOUCH SCREEN CONSOLE

For systems using a CTSC Console, perform the following connections:

1. Remove back covers of the CTSC Touch Screen Console as indicated in *Section 2.5.2.*

2. Connect the Interface Box–Computer Cable (A21089-XX) to COM1 (Communication) and J1 (Auto ON/OFF) of the CTSC Touch Screen Console connectors.





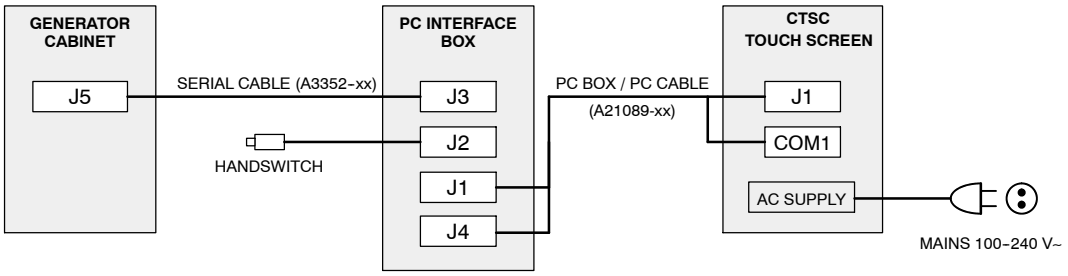
3. Connect the Power Line Cable to the Power Supply (AC/DC Adapter).

4. Re-install the covers of the CTSC Touch Screen Console *(refer to Section 2.5.2).*

5. Remove the Back Cover of the PC Interface Box.

6. Connect the Serial Interconnection Cable (A3352-xx) from J5 of the Interface board of the Generator to J3 of the PC Interface Box .

Illustration 3-6
Interconnections with the A16296-XX Interface Box



7. Connect the Handswitch Cable to J2 of the PC Interface Box.

8. Connect the Interface Box–Computer Cable (A21089-xx) to J1 and J4 of the PC Interface Box. The other end (connectors J1 and COM1) has been connected already to the CTSC Touch Screen Console.

9. Re-install the back cover of the PC Interface Box.

10. Connect the Power Line Cable to the mains (100 – 240 V~).

VIRTUAL CONSOLE (PC)

Systems using a Virtual Console running on a PC usually must have a PC Interface Box installed between the PC and Generator (*refer to the Schematics document).*

Perform the following connections:

1. Remove the Back Cover of the PC Interface Box.

2. Connect the Serial Interconnection Cable (A3352-xx) from J5 of the Interface board of the Generator to J3 of the PC Interface Box.

3. Connect the Handswitch Cable to J2 of the PC Interface Box.

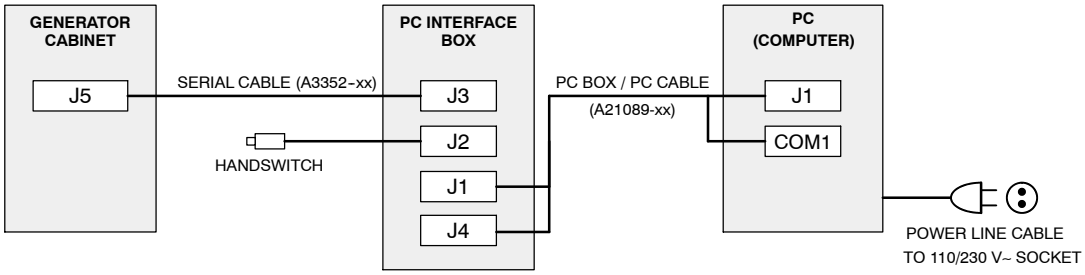
4. Connect the Interface Box-Computer Cable (A21089-xx) to J1 and J4 of the PC Interface Box and the other end (2 connectors) to COM1 (Communication) and J1 (Auto ON/OFF) of the Computer connectors.

Note ☞ *J1 connector is only available in Computers provided with Auto ON/OFF board inside (factory installed).*

5. Re-install the Back Cover of the PC Interface Box.

6. Check to set proper Line Voltage on PC. Plug the Power Line cable for the Computer to a 110 V~ or 230 V~ socket.

Illustration 3-7
Interconnections with the A16296-XX Interface Box



3.4.2 DOOR OPEN INTERLOCK SIGNAL

Connect two wires from the Room Door Interlock Switch(es) to Terminal Strip TS1-35 (/Door open) and TS1-14 (GND).

(Refer to the Configuration document for Door Open Switch Interlock configuration.)

3.4.3 WARNING LIGHT SIGNAL

Room Warning Lamp(s) are lighted when the Handswitch is pressed halfway (prep. position), during X-ray and during fluoro operation.

Room Warning Lamp(s) can be externally powered or internally by the Terminal Strips TS1 and TS2. Room Lamp(s) must be connected through the Terminal Strips TS1 and TS2 to enable the Generator switches to power on/off the Room Warning Lamps.

Connect the cables as indicated in the table below, according to the needed voltage:

Table 3-1
Room Warning Lamps cables connections

VOLTAGE	GENERATOR ON		X-RAYS		
	WIRE 1	WIRE 2	WIRE 1	WIRE 2	JUMPER
230 AC	TS2-12*	TS2-20	TS2-12*	TS2-7	TS2-8 — TS2-21
110 AC	TS2-16*	TS2-20	TS2-16*	TS2-7	TS2-8 — TS2-21
24 VDC	TS1-21	TS1-14	TS1-22	TS2-7	TS2-8 — TS1-13

** Connect both wires to the same connector or use TS2-10 or TS2-11 for 230 AC and TS2-14 or TS2-15 for 110 AC if not in use for the Table and Wall Stand receptors.*

3.4.4 SYSTEM LOCKS

To supply power from the Generator to the System Locks (Table, Wall Stand, etc.) connect the wires from the Locks to Terminal Strip TS3-1 (+24 VDC) and TS3-8 (0 VDC), to TS3-2 (+24 VDC) and TS3-7 (0 VDC) or to TS3-3 (+24 VDC) and TS3-6 (0 VDC) of the Interface board.

Illustration 3-8
System Locks connections

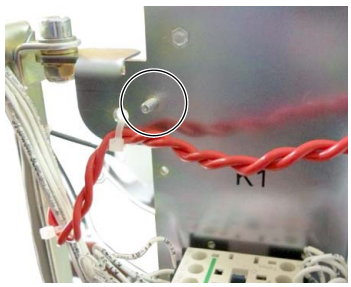
3.4.5 BUCKYS/DETECTORS

Connect the power supply cable of the detector as indicated in the table below:

DETECTOR CABLE	WIRE 1		WIRE 2
	For 230 V~ connection	For 120 V~ connection	0 V~
Table cable	TS2-10	TS2-14	TS2-18
Wall Stand cable	TS2-11	TS2-15	TS2-19

Note ☞ *Refer to the Schematics document or to the corresponding Service note to check the respective Detector interconnection map for complete wiring connection.*

Illustration 3-9
Earth ground stud in the rear side of the front door for detector cables



3.4.6 COLLIMATOR LAMP

The Generator can supply power to the Manual Collimator Lamp.

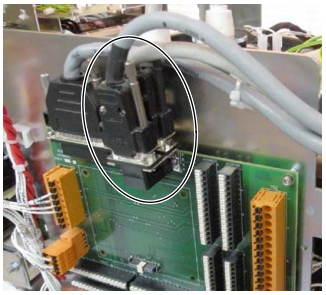
Connect wires from the Collimator Lamp to Terminal Strip TS2-23 (24 V~) and TS2-24 (0 V~) of the Interface board.

3.4.7 ION CHAMBERS FOR AEC (OPTIONAL)

For one Ion Chamber connection, connect the cable to J6 (AEC 1) on the Interface board. Connect the second Ion Chamber cable to J7 (AEC 2) when using two Ion Chambers.

Claymount, Vacutec and AID Ion Chambers are compatible with the Generator *(refer to schematic 6011002 in the Schematics document).*

Illustration 3-10
AEC connections

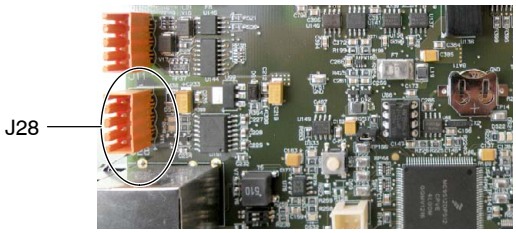


3.4.8 INTERNAL DOSIMETRY (OPTIONAL)

For Dosemeter connection, use the A15212-XX cable connected to J28 of the A3640-XX Control board *(refer to schematic 6005007 in the Schematics document).*

Note ☞ *Refer to the Configuration document for the Dosemeter configuration.*

Illustration 3-11
Dosemeter connector



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SECTION 4 FINAL INSTALLATION AND CHECKS

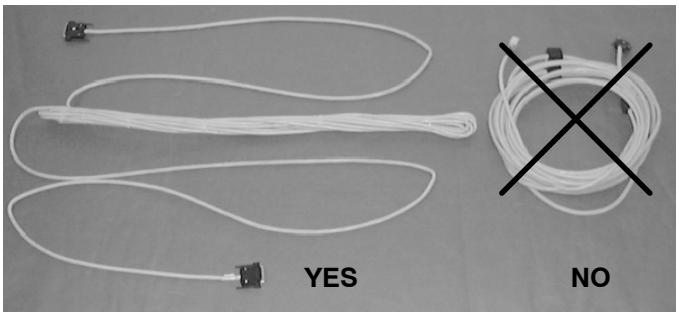
4.1 CABLE FASTENING AND COVERS

Note ☞ *Before re-installing cabinet covers, perform the rest of the required Calibration procedures (i.e. AEC, Fluoro, ABC).*

Check that all electrical connections are firm and secure. Cables should be correctly routed. *(Refer to Section 3.1.)*

CAUTION

In order to avoid signal interferences, it is strongly recommended to fold and fasten close to the Generator Cabinet the portion of cables not routed (see picture below). Never wrap in circles.



Re-install the Cabinet covers and connect its internal ground wires. Power line, High Voltage and Interconnection cables must go through the cover cable outlet.

Illustration 4-1
Internal ground wires

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SECTION 5 SYSTEM INTERCONNECTIONS

5.1 SYSTEM INTERCONNECTION SIGNALS

All input signals are active low. This means the inputs must be pulled to ground (chassis ground of the Generator) thru relay contacts, by a transistor or other switching device. The current requirement of the switch is less than 10 mA.

Do not apply 115/220 V~ logic signals to any of the logic inputs. If 115/220 V~ logic signals are used in the X-ray table (i.e. fluoro command), these signals must be converted to a contact closure by a relay.

The outputs signals from the Generator to the subsystem devices are usually active low (switched to chassis ground of the Generator). The outputs are open collector transistor drivers *(refer to the A3640-XX Control board schematics for their maximum current).*

Table 5-1
System Interconnection Signals

SIGNAL NAME	SIGNAL DIRECTION	SIGNAL DESCRIPTION
CT	Internal	Tank Feedback Connector Plugged in. This signal is low when the switch in the high voltage transformer is in the RAD position. This is a safety interlock which prevents an exposure if the high voltage switch (in the HV Transformer) is in the wrong position.
/LINE CONT		A low signal energizes the main line contactor K2 in the Power Module.
/CHRG_DR		Shorts the Precharge resistors of the DC-BUS.
TANK PRESOSTAT		This signal acts as an interlock when the tank gets automatically opened due to overheat.
ABC_FDBK	Input	This analog input is the output from Imaging System. A DC level signal is used for systems that use an Imaging System for Brightness level. When a DC level is used, an input range of 0 to 10 volts is required. The stabilized value of the input will be between 5 and 7 volts.
VCC_EXT	Input	External voltage supply required for the Bucky motion, when this voltage is not +24 VDC.
/BUCKY MOT1 RTN	Input	This active low signal from Bucky-1 indicates Bucky-1 motion, and therefore the exposure is enabled.
/BUCKY MOT2 RTN	Input	This active low signal from Bucky-2 indicates Bucky-2 in motion, and therefore the exposure is enabled.
/SYNCFL_EXT	Input	Sync. signal from Imaging System. This signal is used for timing in the Generator.
/DOOR_OPEN	Input	This low signal is the interlock for the Door of the X-ray room.
/SYNC RAD	Input	Sync. signal from the DSI device. This signal is used for timing in the Generator.

Table 5-1 (cont.)
System Interconnection Signals

SIGNAL NAME	SIGNAL DIRECTION	SIGNAL DESCRIPTION
/FLUORO_ORDER	Input	This active low signal indicates the Fluoro exposure command. It is needed for Pulsed Fluoro at variable rate.
RAMP1	Input	This input is the output of the Ion Chamber 1 (normally the Table Ion Chamber).
RAMP2	Input	This input is the output of the Ion Chamber 2 (normally the Wall Stand Ion Chamber).
/kV_DWN_EXT	Input	A low signal is a command for the Control board to drive the Fluoro kVp DOWN during a Fluoro exposure in ABC mode.
/kV_UP_EXT	Input	A low signal is a command for the Control board to drive the Fluoro kVp UP during a Fluoro exposure in ABC mode.
/TERMOSTATO	Input	Thermostat. This signal from X-ray Tube indicates the overheat of the Tube.
SCAN	Input	Analog input signal proportional to a kV or mA value when the SCAN mode of the Generator is active.
SCOPE_INPUT	Input	J30 on the Control board. Analog input connection only for signals up to 25V referenced to the Control board ground.
INTERLOCK_1	Input	Active low signal configurable to inhibit X-ray exposures and even to abort them.
INTERLOCK_2	Input	
INTERLOCK_3	Input	
INTERLOCK_4	Input	
/KEY_NC	Input	Active low signal for the Key Interlock configurable to inhibit X-ray exposures.
/ALOE	Output	This active low signal indicates the Actual Length Of Exposure. This signal is used to interface to some Spot Film systems and is used to advance the Spot Film device to the next position when multi-exposures are made on the same film.
/ALOE_DIG	Output	This active low signal indicates the Actual Length Of Exposure. This signal is used to interface to some Spot Film systems which require a minimum length of ALOE and is used to advance the Spot Film device to the next position when multi-exposures are made on the same film.
BUZZER	Output	A low signal energizes the Fluoro buzzer.
/BUCKY DR1	Output	A low signal to the Control board as a command to output a Bucky-1 (normally the Table Bucky) drive signal.
/BUCKY DR2	Output	A low signal to the Control board as a command to output a Bucky-2 (normally the Wall Stand) drive signal.
BUCKY1 SPLY	Output	Voltage supply required for the Bucky 1 drive command.
BUCKY2 SPLY	Output	Voltage supply required for the Bucky 2 drive command.
/FLD1 CAM1	Output	A low signal to select the right field in the Ion Chamber 1.
/FLD2 CAM1	Output	A low signal to select the left field in the Ion Chamber 1.
/FLD3 CAM1	Output	A low signal to select the center field in the Ion Chamber 1.
/FLD1 CAM2	Output	A low signal to select the right field in the Ion Chamber 2.
/FLD2 CAM2	Output	A low signal to select the left field in the Ion Chamber 2.
/FLD3 CAM2	Output	A low signal to select the center field in the Ion Chamber 2.
/PREP	Output	Commands to the Control board to boost X-ray Tube Filament to the value of mA selected and to start the X-ray Tube Rotor if RAD Tube is selected.

Table 5-1 (cont.)
System Interconnection Signals

SIGNAL NAME	SIGNAL DIRECTION	SIGNAL DESCRIPTION
/READY	Output	This active low signal indicates the system is ready to make an exposure (Prep cycle complete). This signal is used to interface to certain peripheral devices such as Film Changers, etc.
/ROOM_LIGHT	Output	This low going signal indicates the X-ray preparation or exposure. This signal is used to interface to the Room X-ray warning light.
START_DR1	Output	A low signal to indicate the start of an exposure to the Ion Chamber 1.
START_DR2	Output	A low signal to indicate the start of an exposure to the Ion Chamber 2.
/GEN_OK	Output	This active low signal indicates that the Generator is not initializing or it is in error condition.
/EXP	Output	Active low signal to the Control board. If /PREP is low, then a Spot Film, RAD exposure or a Fluoro exposure is made.
READY_ISO	Output	Output to digital systems that require it.
ALOE_ISO	Output	
EXP_ISO	Output	
PREP_ISO	Output	
J25	Input/Output	Serial communications port on the Control board. Configurable for RS232, RS422 or RS485.
J28		Serial port on the Control board. Configurable either for general use or for the Dosemeter.
CAN0		J9 connector on the Control board. This signal is used for software upgrade and for external communications.
CAN2		J19 connector on the Control board.

5.2 SYSTEM INTERCONNECTION MAPS

Refer to the Schematics document for the system interconnection maps.

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