

Technical Publication
TR-1108R9

Troubleshooting

HF Series Generators

REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
0	APR 15, 2014	First Edition.
1	DEC 04, 2014	System Errors and Replacement of the Booster Module and Dual Speed Starter updated.
2	MAR 06, 2015	System Errors and Replacement of the Control board updated.
3	OCT 19, 2015	Software update and Power Supply test updated, CTSC Console added, New System Errors, Replacement procedures updated.
4	SEP 30, 2016	Software update, System Errors and Replacement of the Control board updated.
5	JAN 23, 2017	Boards Test Points and layouts, replacement of the Booster IGBT.
6	JUN 22, 2017	Software update, System Errors, Booster module, Booster IGBT and Power Supply replacement procedures updated.
7	NOV 29, 2019	HV Tank resistance measurement updated, Troubleshooting for the CTSC Touch Screen Console updated, Errors 012 and 019 updated, Errors 131, 135, 143, 150, 166 and 172 deleted.
8	MAR 19, 2020	Test Points Use and Location Section removed, Errors updated.
9	JUL 22, 2020	Ethernet connection and new Central Listings section.

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 HEDED OR AVOIDED WILL CAUSE SERIOUS PERSONAL INJURY OR DEATH.



ADVISE OF CONDITIONS OR SITUATIONS THAT IF NOT HEDED 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 Generator contains many self-diagnostic routines which greatly facilitate troubleshooting. Self-diagnostic functions require a proper performance of all microprocessors. Each microprocessor contains LEDs that indicate correct operation.

As a general rule, the first step in any troubleshooting procedure is to verify the correct Power Supply Voltages and perform a visual inspection of all boards and cable connections.

Upon arrival at the X-ray Room, the Service Engineer should carry out the following operations:

- Check which Error Code is displayed on the Console and run the troubleshooting routines for the last Error Code displayed.
- If there is no error code displayed, try to reproduce the failure in the conditions reported by the Operator. The Error Code displayed might be different from the one reported. In all cases, run the troubleshooting routines for the last Error Code displayed.



Whenever the HV Transformer or X-ray Tube is replaced in the Generator, the respective configuration and calibration procedures must be performed.

If the A3640-XX Control board is replaced, restore the configuration and AEC data from the backup files saved in the computer and perform the required calibration procedures, or transfer the U66-EEPROM from the old board to the new board and perform the calibration procedures. U66-EEPROM contains configuration and calibration data.

If the backup files cannot be restored and U66-EEPROM is not transferred, complete configuration procedure must be performed.

Update and record in the Data Book any new calibration data.

1.1 TOOLS AND TEST EQUIPMENT

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

- Standard service engineer's tool kit, including Allen and Torx key sets and a reversible ratchet with socket set.
- Silicone Insulating Grease (proofing compound) (included in the X-ray Tube package).
- HV Oil (included in the HV Cables package).
- Alcohol cleaning agent.

The following test equipment is required for some configuration and calibration procedures carried out during Troubleshooting:

- Calculator.
- Anti-static Kit.
- Digital Multimeter.
- Non-invasive kVp Meter.
- Digital mAs Meter.
- Oscilloscope (Tektronics 486 or similar).
- 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 μ Gy/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 GENERAL CAUTIONS



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 BEFORE SERVICING THE EQUIPMENT (APPROX. 3 MINUTES AFTER THE UNIT IS TURNED OFF).



TO AVOID ELECTRIC SHOCK, 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.



DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.



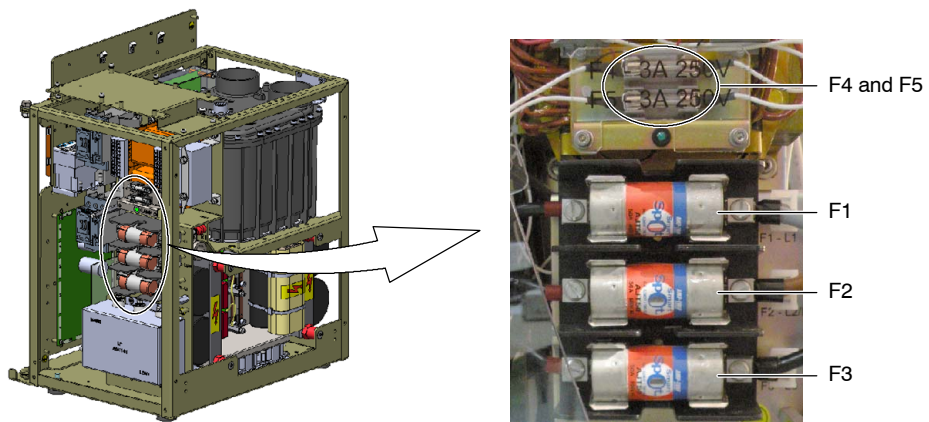
THIS GENERATOR IS PERMANENTLY CONNECTED TO THE POWER LINE AND POWERED ON UNLESS THE SAFETY SWITCH INSTALLED IN THE ROOM ELECTRICAL CABINET IS OFF. WHEN THE GENERATOR IS POWERED, THE NEON LAMP (GREEN) LOCATED IN THE TRANSFORMER T2 (GENERATOR CABINET) IS ON.

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.

1.3 FUSES LIST AND LOCATION

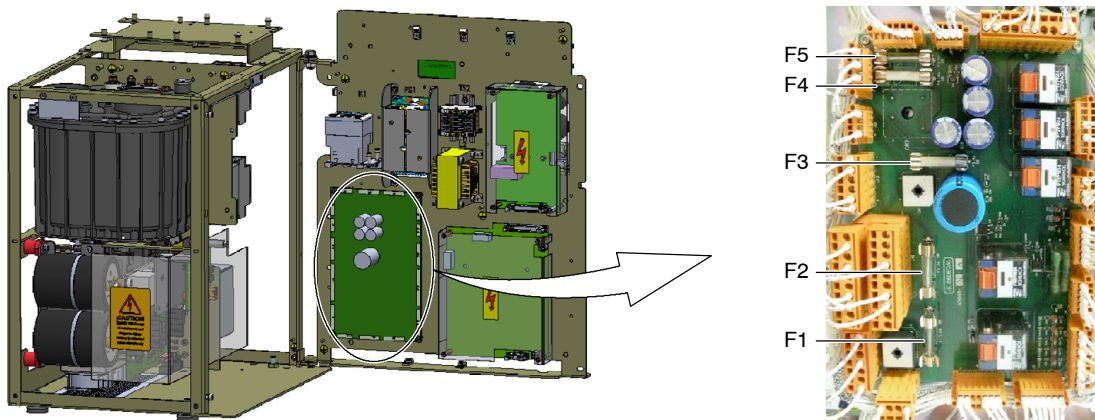
The SHFR Generator is provided with a set of fuses with the next features:

- F1, F2 (and F3):
 - Input line fuses, 50A, 600V, SB.
 - Input line fuses for 50 kW single-phase Generators, 60A, 600V, Time-delay.
- F4 and F5: 3A, 250V, SB.



Fuses located in the A3646-XX Supply board:

- F1: 1.5A, 250V, SB.
- F2: 3A, 250V, SB.
- F3: 4A, 250V, SB.
- F4: 10A, 250V, SB.
- F5: 6,25A, 250V, SB.



SECTION 2 GENERAL PROCEDURES

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 2-1
Internal ground wires

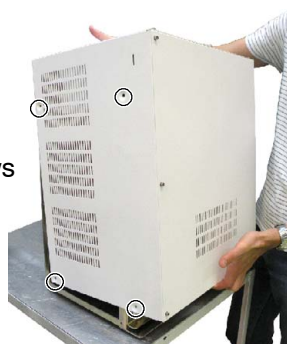


Remove the covers taking care not to pinch any cable. Take the same precautions when installing the covers back.

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 2-2
Covers disassembly

Remove the lateral screws



Optional handles



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

2.2 SOFTWARE UPDATE

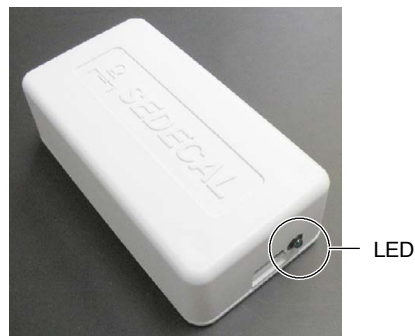
2.2.1 UPDATE VIA CAN BUS

Note 

Only the software of the A3640-XX Control board can be updated using the CAN Bus protocol.

1. Connect the USB-CAN Adapter (A11919-01) to the USB port of the Computer and wait for it to recognize the hardware. The LED of the Adapter should blink. If it remains off, there might be a hardware problem. On the other hand, if the LED is lighted but it does not blink, the Adapter might not be properly configured.
 - Let the operating system search and download the drivers.
 - If the operating system can not download the drivers, plug in the computer the USB with the Software Service Tools, select to install the drivers from specific location and select the location of the USB drive.

Illustration 2-3
USB-CAN Adapter



2. Once installed, connect the RJ45 cable (A7312-01) from the Adapter to J9 on the A3640-XX Control board of the Generator and install the downloader application. It can be connected either to J9A or J9B of the Control board. The downloader is used to update the Generator software.

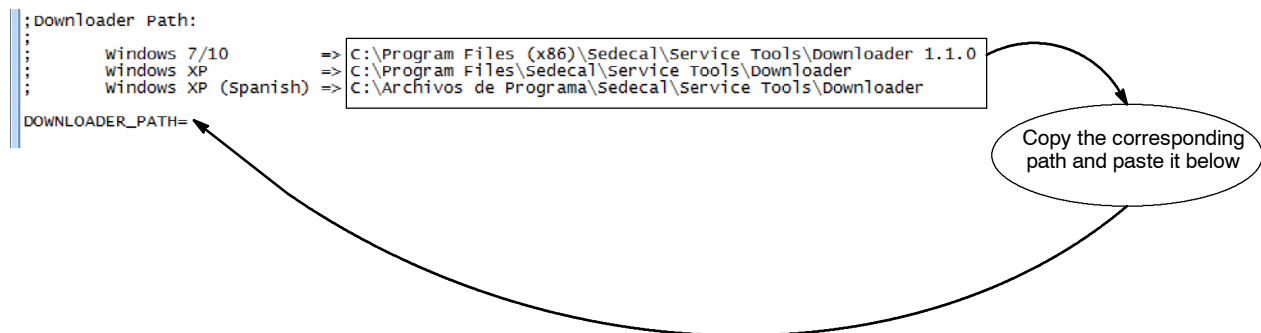
Note 

It is recommended to install the downloader to the default path, so it can be easily configured to be launched from the Service Console.

3. To be able to launch the downloader from the Service Console, open the ServiceConsole.ini file located in the Tech Service Console folder (*refer to Illustration 2-4*) with the Notepad and select the path where the downloader has been installed. If it has been installed in the default path, copy the corresponding line according to the operating system in use and paste it after the parameter DOWNLOADER_PATH=.

Illustration 2-4

Downloader path in the ServiceConsole.ini file



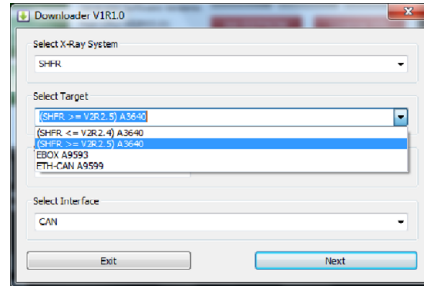
4. Start the Software Downloader by clicking on its desktop icon or from the Service Console by pressing the “Software Update” button.

Note

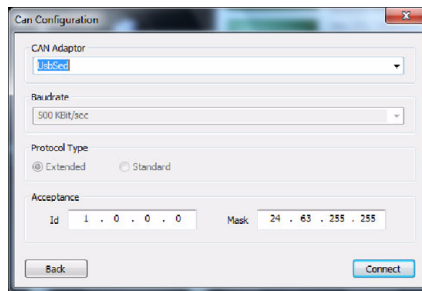
When upgrading the software to V02R02.05 or higher from a version previous to V02R02.05 or downgrading from V02R02.05 or higher to a version previous to V02R02.05, it is necessary to remove jumper W1 before turning on the Generator or to reboot the Generator using SW3 after removing the jumper (refer to the Control board layout in the Central Listings document for W1 and SW3 location). Don't forget to install again the jumper once the software update is finished, before rebooting the Generator.

5. Choose the following options:
 - a. Select X-ray System: **SHFR**.
 - b. Select Target:
 - **(SHFR <= V2R2.4) A3640**. Select this option if the software version to be installed is older than V2R2.5.
 - **(SHFR >= V2R2.5) A3640**. Select this option if the software version to be installed is V2R2.5 or higher.

- c. Select Update: **Software**.
- d. Select Interface: **CAN**.



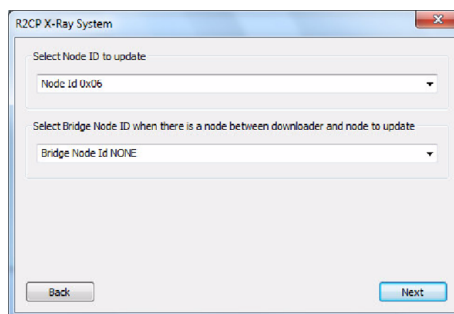
- 6. Click on “Next”. Select the CAN Adaptor “**UsbSed**” and then, click on “Connect”.



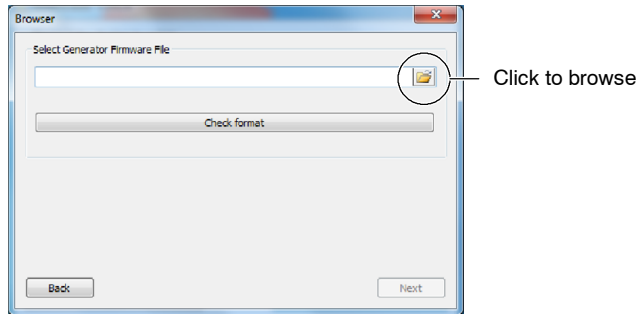
Note 

Unplug and plug again the USB cable from the computer to the Adapter in case an error message is shown when trying to connect with the Generator. Wait a few seconds and then, click on “Connect”.

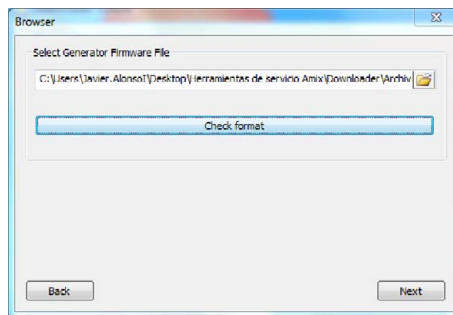
- 7. Check that “Node Id 0x06” and “Bridge Node Id NONE” are selected. Then, click on “Next”.



8. To select the file to be downloaded in order to update the software, browse for the .s19 file and open it. Make sure that the selected version of the .s19 file is compatible with the revision of the A3640-XX Control board mounted on the Generator.

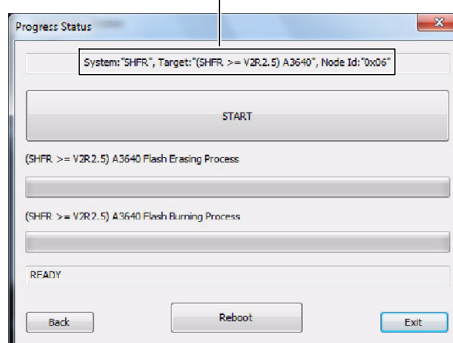


9. Click on "Check format" and then click on "Next".



10. Check that the selected options for the update are correct and click on the "START" button to begin the software update downloading.

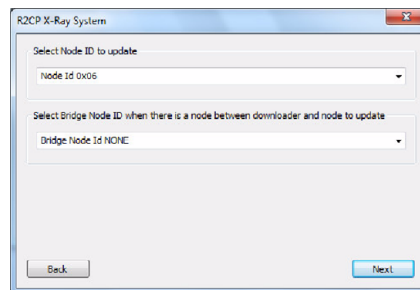
Check the selected options



Note 

If the wrong software is loaded to the Generator or software update is interrupted before finishing the process, remove jumper W1 (refer to the Control board layout in the Central Listings document for W1 location) and reset the Generator. The equipment will not complete the startup process, as it will be ready for the software update. Then, repeat the whole process. Don't forget to install again the jumper previously removed once the software update is finished and finally, reboot the Generator.

11. Wait until the "SUCCESS!" message is displayed. That means the software has been successfully updated. Install jumper W1, if previously removed, and click on the "Reboot" button to shut down the Generator and reboot it to complete the update.



Note 

Once the software has been updated, there might be new configuration options available. Check the Configuration screen of the Service Console and update the values if necessary (refer to the Configuration document).

2.2.2 UPDATE VIA ETHERNET (FOR GENERATORS EQUIPPED WITH THE HW BUS-SHFR ADAPTATION BOARD)

Note 

Both the A3640-XX Control board and the A9599-XX HW BUS-SHFR Adaptation board can be updated using the Ethernet protocol.

1. Connect or check that the Ethernet cable is connected to J8 of the HW BUS-SHFR Adaptation board.
2. Start the Software Downloader by clicking on its desktop icon.

2.2.2.1 CONTROL BOARD SOFTWARE UPDATE

1. Choose the following options:
 - a. Select X-ray System: **SHFR**.
 - b. Select Target:
 - **(SHFR <= V2R2.4) A3640**. Select this option for software versions older than V2R2.5.
 - **(SHFR >= V2R2.5) A3640**. Select this option for software version V2R2.5 or higher.
 - c. Select Update: **Software**.
 - d. Select Interface: **ETHERNET**.
2. Click on "Next". Check that all the fields in the "Ethernet Configuration" screen remain blank and click on "Next".
3. Insert the Smarthub IP: 192.6.1.201 and Port 2000. Then, click on "Connect".
4. Perform steps 7. to 11. of Section 2.2.1.

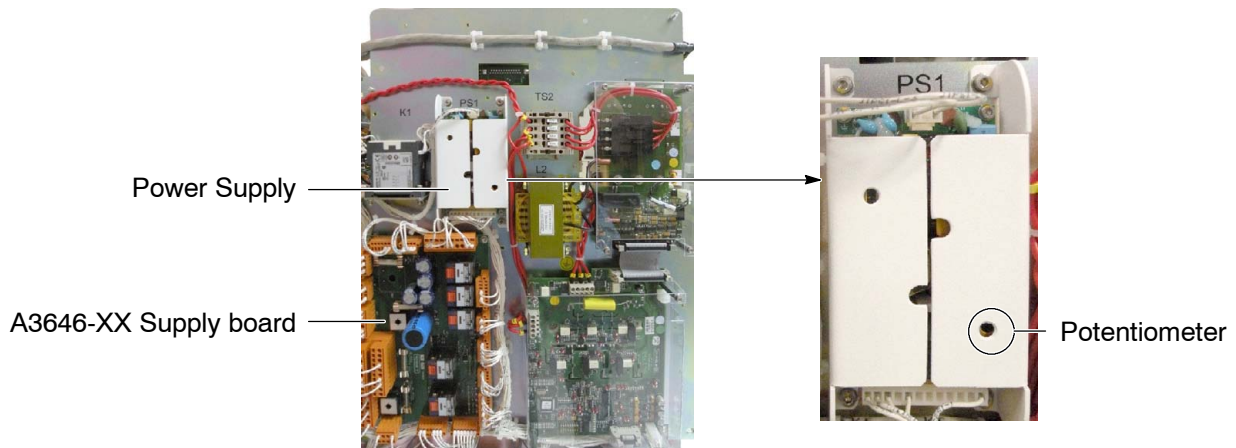
2.2.2.2 HW BUS-SHFR ADAPTATION BOARD SOFTWARE UPDATE

1. Choose the following options:
 - a. Select X-ray System: **SHFR**.
 - b. Select Target: **ETH-CAN A9599**.
 - c. Select Update: **Software**.
 - d. Select Interface: **ETHERNET**.
2. Click on "Next". Check that all the fields in the "Ethernet Configuration" screen remain blank and click on "Next".
3. Insert the Smarthub IP 192.6.1.201 and Port 2000 in the "Target Ethernet Configuration" field; and the Bootloader IP 192.168.105.12 and Port 69 in the "Bootloader Ethernet Configuration" field. Then, click on "Connect".
4. Perform steps 8. to 11. of Section 2.2.1.

2.3 LOW DC VOLTAGE POWER SUPPLY TEST

The Generator operates from a Low DC Voltage Power Supply located in the Back Panel of the Generator Cabinet (*refer to Illustration 2-5*).

Illustration 2-5
Power Supply and A3646-XX Supply board in the Back Panel



Turn the Generator ON and with a Digital Multimeter measure:

- **+5 V_{DC}** between TP4 and GND (TP8, TP9, TP10 or TP11) or between J6-1 and J6-4 on the A3646-XX Supply board. Check that the voltage at this point is **+5.15 V_{DC} ± 100mV** (LED DS3).
- **+5 V_{DC} delayed** between TP5 and GND (TP8, TP9, TP10 or TP11) or between J15-1 and J15-3 on the A3646-XX Supply board. Check that the voltage at this point is **+5.15 V_{DC} ± 100mV** (LED DS7), present once the startup sequence is completed.
- **+15 V_{DC}** between TP6 and GND (TP8, TP9, TP10 or TP11) or between J6-2 and J6-4 on the A3646-XX Supply board. Check that the voltage at this point is **+14.9 V_{DC} ± 800mV** (LED DS4).
- **-15 V_{DC}** between TP7 and GND (TP8, TP9, TP10 or TP11) or between J6-3 and J6-4 on the A3646-XX Supply board. Check that the voltage at this point is **-15 V_{DC} ± 750mV** (LED DS5).
- **+24 V_{DC}** between TP1 and GND (TP8, TP9, TP10 or TP11) or between J6-5 and J6-4 on the A3646-XX Supply board. Check that the voltage at this point is **+28 V_{DC} ± 3V** (LED DS2).
- **+24 V_{DC} delayed** between TP3 and GND (TP8, TP9, TP10 or TP11) or between J6-6 and J6-4 on the A3646-XX Supply board. Check that the voltage at this point is **+23.1 V_{DC} ± 1.2V** (LED DS8), present once the startup sequence is completed.

If required, **adjust the voltage with the +5 V^{DC} Adjustment Potentiometer** on the Power Supply (*refer to Illustration 2-5*). The Adjustment Potentiometer affects not only the +5 V^{DC}, but take into account that +5 V^{DC} has to be always measured when adjusting any other voltage, as this is the one that is being adjusted with the Potentiometer in the first place.

If the measured voltage is not correct, remove the covers of the Low Voltage Power Supply and check J1 (230V~). Check J1-1 on the A3646-XX Supply board (230V~), Fuse F1 and Contactor K1 (*refer to schematic 54302260*).

+24 V^{DC} permanent, always present, can be measured between TP2 and GND (TP8, TP9, TP10 or TP11) on the A3646-XX Supply board. The voltage at this point must be **+29.7 V^{DC} ± 3V** (LED DS1). This voltage is not generated in the Power Supply.

Note 

No adjustments are required for voltage measurements.

2.4 PROCEDURES RELATED TO THE PUSH-BUTTON CONSOLE

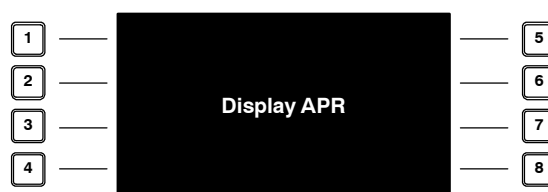
2.4.1 APR OPERATION

APR techniques are factory pre-programmed to standard techniques sets. All parameters of APR techniques may be manually rewritten as required by the operator and stored in the “APR working file” for later use (*refer to the respective Operator Manual*).

Note 

This section only applies to Push-button Consoles equipped with Anatomical Programmer (APR).

Illustration 2-6
APR Module in Push-button Console



2.4.2 APR RE-INITIALIZATION

The Control Console EEPROM contains two copies of the APR, the “APR working file”, which is the one in use, and the factory pre-programmed parameters of the APR techniques, which is a backup copy of the original APR.

The APR re-initialization replaces the “APR working file” with the factory pre-programmed parameters of the APR techniques.

To re-initialize the APR techniques, press simultaneously the push-buttons 5-6-7-8 on the APR module. (Refer to Illustration 2-6).



The APR re-initialization deletes all the APR parameters and related selections previously modified and stored by the operator.

2.4.3 APR BACKUP

Note 

Additional APR Editor software is required for this operation.

The APR Backup can be used to transfer a copy of the “APR working file” from the Control Console EEPROM to an external PC. With APR mode inactive, press “AEC Reset” + “Medium patient size” for PC connection mode:



APR Display shows the following message: “APR EDITION MODE”. Press the same push-buttons combination to exit PC connection mode. The message disappears from the APR Display and connection with the PC is lost.

To perform a backup of the “APR working file”, refer to the *APR Editor Appendix*.

2.4.4 APR RESTORE

The APR Restore replaces both APR files in the Control Console EEPROM with other APR file sent from an external PC.

To restore the APR techniques, refer to the *APR Editor Appendix*.



The APR restore deletes the factory pre-programmed parameters of the APR techniques previously stored in the Control Console EEPROM.

2.5 PROCEDURES RELATED TO THE CTSC TOUCH SCREEN CONSOLE

2.5.1 TROUBLESHOOTING FOR THE CTSC TOUCH SCREEN CONSOLE

POSSIBLE CONDITIONS	
PROBLEM NUMBER	DESCRIPTION / CIRCUMSTANCE
1	THE CONSOLE AND GENERATOR DO NOT START-UP
2	THE CONSOLE STARTS-UP BUT THE GENERATOR DOES NOT START-UP.
3	THE CONSOLE BEEPS BEFORE START-UP
4	THERE IS NO IMAGE ON THE SCREEN
5	OPERATING SYSTEM NOT LAUNCHED OR START-UP ANOMALIES
6	CTSC CONSOLE FANS HAVE STOPPED
7	THE TOUCH SCREEN DOES NOT RESPOND TO THE TOUCH

Note 

Ensure that the Generator and CTSC Touch Screen Console are powered ON.

Certain problems described below are circumstantial and assume a correct functioning of the equipment.

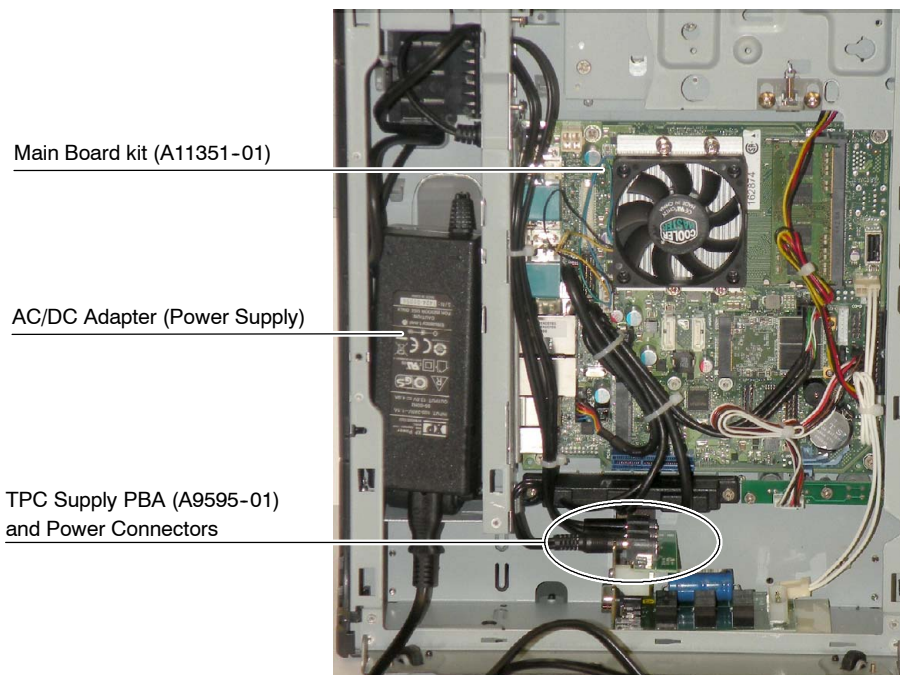
PROBLEM 1: THE CONSOLE AND GENERATOR DO NOT START-UP

Theory:

The CTSC Console controls its start-up procedure and also of the X-ray Generator. If it is not properly powered, it will not be able to start nor the operating software, nor the X-ray Generator.

Possible Causes:

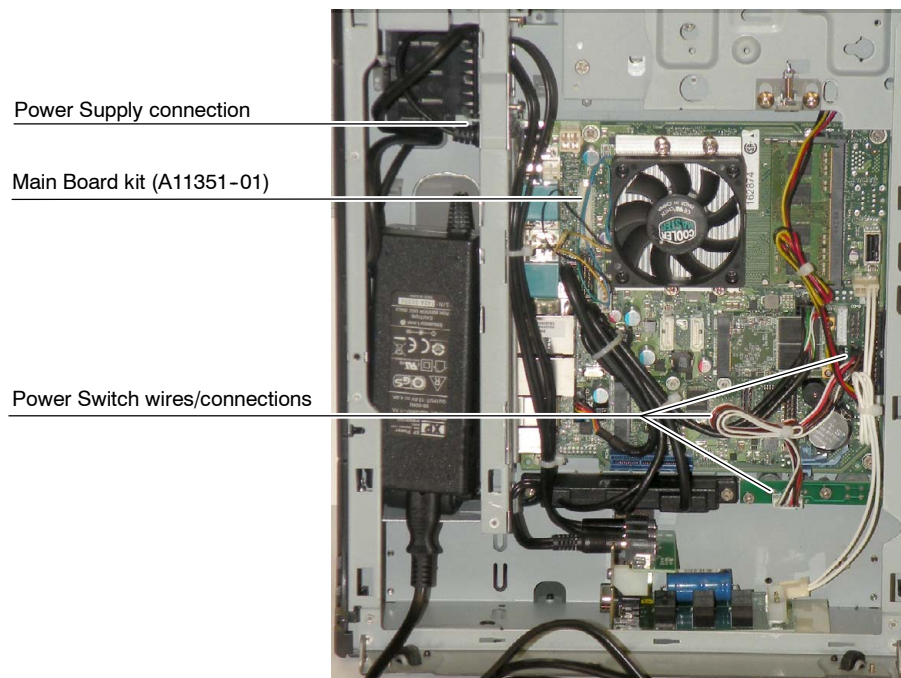
The AC/DC Adapter could be damaged, but it could be also a problem with the power connectors, the TPC Supply PBA (A9595-01) or the Main Board Kit (A11351-01) which would be damaged. Follow the steps below:



1. Check that the AC/DC Adapter (Power Supply) is correctly connected to the mains and its LED is green lighted. If the LED is green lighted, proceed to verify that the connection with the Console is correct.
2. Open the back covers of the Console as indicated in the Installation procedure.

3. Check in TPC Supply PBA (A9595-01) that the power supply is correct and connectors/cables are not damaged or disconnected:
 - a. Check for 12 V $\overline{=}$ with a multimeter in the DC Power connector of the cable from the AC/DC Adapter. Replace the Power Supply if the reading is not correct.
 - b. Check for 12 V $\overline{=}$ in all connectors of TPC Supply PBA (A9595-01) and that cables are properly connected.

4. Once previous step is completed, check that the following connectors/wires in the Main Board (A11351-01) are correctly connected: Power Supply and Power Switch.



5. If the connection is correct, it might be a problem of the Main Board Kit (A11351-01), so it must be replaced. The Main Board Kit includes the operation software, so it is highly recommended to complete a backup of the APR whenever it has been previously modified (*refer to Section 2.5.3*).

PROBLEM 2: THE CONSOLE STARTS-UP BUT THE GENERATOR DOES NOT START-UP

Theory:

This may be an error due to a incorrect connection of CTSC Console with the Generator, which may be not properly powered.

Possible Causes:

This may be due to an error in the Interface Board (A3674-xx) of the Generator, an incorrect cable connection (Cable A3352-xx) or a malfunction in the Auto ON/OFF Board (A3179-xx).

1. Ensure that the Generator can be turned on independently using the PC Interface Box. If the Generator does not turn on, follow steps 2. and 3. If the Generator turns on, proceed with steps 4. and 5.
2. Check that it is correctly powered and see Error 33 in the Troubleshooting documentation.
3. Check if there is present any damage in the PC Interface Box and in the Interface Box Cable (A3352-xx) and if it is properly connected. Replace it in case that it is damaged.
4. Check that the A21089-XX Cable is correctly connected to the CTSC Console and to the PC Interface Box (*refer to the general wiring schematic 6005003 in the Schematics document*).
5. Check for 12 V in J4 connector of the Auto ON/OFF Board (A3179-xx). Replace the Main Board Kit (A11351-01) if the reading is not correct or replace the Auto ON/OFF Board (A3179-xx) if the reading is correct.

PROBLEM 3: THE CONSOLE BEEPS BEFORE START-UP

Note 

This may be a temporal corruption during the start-up dialogue, restart the console to confirm fault before attempting service.

Theory:

The Video Chip Set or DRAM will be at fault when the console, during start-up, emits either a single long beep followed by three short beeps (— · · ·) or a continuous series of long beeps (— — —).

Possible Causes:

These are BIOS errors and may be caused by either a corrupt power or DRAM connection; or a malfunctioning CTSC Main Board Kit (A11351-01).

Visually check and ensure a proper connection not only on the CTSC Main Board Processor and its ventilator but also on the DRAM board (repairing or replacing if necessary). If there is a proper connection, replace the CTSC Main Board Kit (A11351-01).

PROBLEM 4: THERE IS NO IMAGE ON THE SCREEN

Theory:

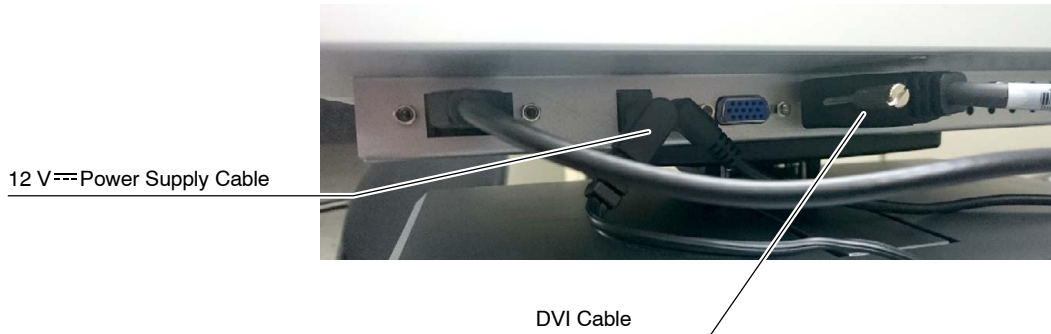
The CTSC Console Monitor is powered by the TPC Supply PBA (A9595-01). When the connection is correct the Monitor must be lighted and displaying the operating software.

The image/data is supplied by the Main Board Kit (A11351-01) using a DVI Cable.

Possible Causes:

The most probable cause is an incorrect connection or damaged DVI Cable; however, a replacement of the other two main components (Monitor and Main Board Kit) may be necessary. Follow the steps below:

1. Turn the CTSC Console ON and check if the “*Status*” indicator is powered (on the lateral of the CTSC Console). If not, check for +12 V in the power supply cable from the TPC Supply PBA (A9595-01). Replace the cable in the event of visible damage.



2. If the previous step is correct, ensure a correct connection of the DVI cable of the monitor. Replace the cable in the event of visible damage.
3. If both cables/connections are correct, then the problem could be the Monitor or the Main Board (A11351-01). Check the Monitor with the cables connected to another PC of a CTSC Console. If the Monitor displays the image, then replace the Main Board Kit (A11351-01). Otherwise, replace the Monitor.

PROBLEM 5: OPERATING SYSTEM NOT LAUNCHED OR START-UP ANOMALIES**Note** 

This may be a temporary corruption or communication failure during the start-up dialogue, restart the console to confirm the problem before attempting service.

Theory:

This problem is caused by a damaged SSD Disk of the CTSC Console or when there is a malfunction in it.

Possible Causes:

The CTSC Console turns on but the operating software does not complete the start up procedure. It unsuccessfully searches for the SSD Disk and, then, tries to use other starting devices. Messages during the start-up routine such as “*Reboot and select proper boot device*” appear with SSD Disk problems.

The SSD Disk is a part of the Main Board Kit (A11351-01), it should contain all necessary software for the proper functioning of the Operating Application.

If the problem persists after starting-up the Console several times, replace the Main Board Kit (A11351-01).

PROBLEM 6: CTSC CONSOLE FANS HAVE STOPPED

The Console Ventilation Fan and the CPU cooler cool the Console and the Microprocessor on the Main Board Kit respectively.

Note 

The CTSC Console may suffer irreversible damage if the Console Ventilation fan is not functioning properly. Nevertheless, ensure that the Console functions properly before troubleshooting the fan.

Console Ventilation Fan

1. Visually check for proper power supply cable connections to the fans: Check for 12 V^{DC} on the Power Supply (Console side) of the ensemble.

CPU cooler

1. If the CPU cooler is not functioning, the microprocessor on the Main Board Kit (A11351-01) will heat up and eventually freeze the Touch Screen controls and processes. If the system freezes, first try to restart the system. If the condition persists, proceed to the next step.
2. Open the CTSC and see if the CPU cooler is rotating. Visually check connections for broken wires and proper connections. If connections and wires are ok, replace the Main Board Kit (A11351-01) which includes the CPU cooler.

PROBLEM 7: THE TOUCH SCREEN DOES NOT RESPOND TO THE TOUCH**Note** 

This may be a temporary corruption or communication failure during the start-up dialogue, restart the console to confirm the problem before attempting service.

Make sure hands and screen are clean and dry, then try these steps:

1. With the CTSC Control Console OFF, disconnect the USB Cable of the Display.
2. Switch ON the CTSC Control Console and wait until the operating system is running.
3. Connect the USB Cable and check if the Touch Screen is working properly now.
4. If it does not work properly yet, connect an USB keyboard to the PC.
5. Press the “Windows” key and launch “Control Panel\Device Manager\Mice and Other Pointing Devices”.
6. Check that the HID Compliant Mouse is listed, check the USB Cable is correctly connected to the PC and try to change the USB connector or the same USB Cable.
7. In both cases, if the Monitor does not respond correctly it must be necessary to replace it.

2.5.2 SOFTWARE UPGRADE

If the Touch Screen Application is provided with a “*Software Upgrade*” button on the Service Mode Menu, it is used to close the Application Program without turning OFF the System. After pressing this button, the Console shows the PC Desktop to enable the Application Software Upgrade.

Note 

To perform any of these operations, it is necessary to connect a USB Keyboard at the bottom of the CTSC.

2.5.3 EXTERNAL BACKUP OF THE APR TECHNIQUES AND ERROR LOG



DURING THE BACKUP PROCESS IT IS NECESSARY TO ACCESS TO THE OPERATING SOFTWARE MAIN FOLDER. IT IS ABSOLUTELY MANDATORY NOT TO DELETE OR MODIFY ANY FILE IN THIS FOLDER, EXCEPT WHEN INDICATED, IN ORDER TO NOT CORRUPT THE CORRECT PERFORMANCE OF THE SOFTWARE.

1. Connect a USB keyboard to the CTSC Console.
2. Connect the external device where the backup will be recorded to the other USB port of the CTSC Console.
3. Press the “*Windows*” key, select “*Computer*” and browse to the following folder: “*Computer\Local Disk (C:)\Program Files (x86)\Sedecal*”.
4. Copy “*APRBckUp*” and “*Fichero*” files to the external device.
5. Close the “*Windows Explorer*” and disconnect the keyboard and the external storage device from the USB ports of the CTSC Console.

To restore the APR techniques and Error log backup files just copy and rewrite the current files in the “*Sedecal*” folder of the CTSC Console.

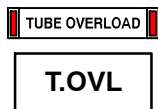
SECTION 3

SELF-DIAGNOSIS INDICATORS

Some Consoles are provided with Self-Diagnosis indicators that identify malfunctions in the system, alerting the operator about any error existence that may inhibit exposures. During normal system operation, these indicators are directly shown on the Console (depending on the Console model they can be shown on the APR Display, Console Indicators, Warning Messages Area, etc.).

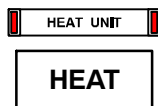


DOOR OPEN: Indicates the X-ray room door is open when the X-ray equipment is in use. *(Also refer to Error Code "E48").*



TUBE OVERLOAD: Indicates that either the technique selected is beyond the X-ray tube ratings or the present conditions of the X-ray tube inhibit the exposure (anode overheated). Parameters for next exposure may be temporally limited by the Generator (change the exposure values or wait for the X-ray tube to cool). *(Also refer to Error Code "E37").*

Check that available heat units are lower than calculated for the next exposure. Reduce exposure factors or wait for the X-ray tube to cool.



HEAT: Indicates that the X-ray Tube thermostat / pressurestat is open due to overheating of the tube housing (housing is too hot, wait for the housing to cool) or to a thermostat / pressurestat mal-function (housing is cool). Heat units may raise to any value. *(Also refer to Error Code "E36").*

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SECTION 4 ERROR CODES

Table 4-1
Error code list

ERROR CODE	DESCRIPTION
E001	BACKUP TIMER — I2C ERROR I2C bus error while trying to access the external redundant backup timer.
E002	WRONG WS CONFIGURATION ERROR One or more workstations are not properly configured; a default value has been assigned.
E003	NO WS CONFIGURED ERROR No tube has been configured for any of the workstations, there is no workstation available and a default value has been assigned.
E004	FLUORO ORDER ERROR The Fluoro order input signal is active during the startup sequence.
E005	EXP ORDER ERROR The Exposure order input signal is active during the startup sequence.
E006	PREP ORDER ERROR The Preparation order input signal is active during the startup sequence.
E007	TUBE2 MODEL ERROR The tube index (related to a tube in the tube list) configured for the tube 2 is outside boundaries, a default value has been assigned.
E008	TUBE1 MODEL ERROR The tube index (related to a tube in the tube list) configured for the tube 2 is outside boundaries, a default value has been assigned.
E009	INVERTER ERROR (IGBT FAULT) The inverter module has been overloaded.
E010	EEPROM CHECK ERROR Erroneous data stored in the EEPROM.
E011	LOAD CAPACITOR ERROR Error while charging the load capacitors. The DC-BUS voltage does not reach the right value during startup.
E012	mA RANGE ERROR Tube current out of range during exposure.
E013	kVp RANGE ERROR Anode-Cathode voltage out of range during exposure.
E014	kVp RAMP ERROR Anode-Cathode voltage does not reach the final value in the designated rise time.
E015	LARGE FIL CURRENT RANGE ERROR Large filament current out of range.
E016	SMALL FIL CURRENT RANGE ERROR Small filament current out of range.
E018	ROTOR ERROR The Anode Rotor Controller (starter) is not sending back the Ready condition within the designated time.

HF Series Generators

Troubleshooting

Table 4-1 (cont.)
Error code list

ERROR CODE	DESCRIPTION
E019	mA WITHOUT EXP ERROR Tube current without exposure order from the microcontroller.
E020	kVp WITHOUT EXP ERROR Anode-Cathode voltage without exposure order from the microcontroller.
E023	EEPROM ERROR Error while writing in the EEPROM.
E024	BUCKY/DIGITAL PANEL ERROR The designated time has elapsed since the exposure signal was activated while the equipment was "Ready" without any acknowledge from the WorkStation configured as Bucky or Digital Panel.
E025	LARGE FIL DEMAND ERROR Large filament current demand above the limit.
E026	SMALL FIL DEMAND ERROR Small filament current demand above the limit.
E027	kVp POTENTIOMETER — I2C ERROR I2C bus error while trying to access the digital potentiometer that adjusts the kV oscillator.
E028	ABC POTENTIOMETER — I2C ERROR I2C bus error while trying to access the digital potentiometers that adjust the ABC window.
E029	GENERATOR OVERHEAT ERROR Generator heat capacity exceeded. "Warning".
E030	CORRUPT RTC ERROR Wrong date stored in the Real Time Clock (RTC) and/or in the time stamp.
E031	TIME STAMP CHECK ERROR The time stamp checksum is wrong.
E032	RTC — I2C ERROR I2C bus error while trying to access the Real Time Clock (RTC).
E033	COMMUNICATIONS ERROR The remote console has lost communication with the generator.
E034	TANK PRESOSTAT ERROR Tank presostat opened.
E035	BUCKY MOTION (X-RAY ACK) ERROR The acknowledge for X-rays from the Bucky or FPD has been lost before the end of the exposure.
E036	TUBE THERMOSTAT ERROR Tube thermostat opened. "Warning".
E037	TUBE OVERLOAD ERROR Tube ratings exceeded or not enough Heat Units to perform the selected exposure. "Warning".
E038	+5V POWER SUPPLY FAILURE +5V power supply is out of range.
E039	+15V POWER SUPPLY FAILURE +15V power supply is out of range.

Table 4-1 (cont.)
Error code list

ERROR CODE	DESCRIPTION
E040	IMBALANCED kVp ERROR Imbalanced kVp, there is not the same voltage in Anode and Cathode branches.
E041	IMBALANCED mA ERROR Imbalanced mA, there is not the same current in Anode and Cathode branches.
E042	CORRUPT COUNTERS ERROR The counters checksum is wrong.
E043	CORRUPT ERROR LOG ERROR The error log checksum is wrong.
E044	EEPROM — I2C ERROR I2C bus error while trying to access the EEPROM.
E045	CORRUPT TUBE DATA ERROR The tube data checksum is wrong.
E046	BUSY BUS — I2C ERROR I2C bus error, the bus remains always busy.
E047	LICENCE — I2C ERROR I2C bus error while trying to access the Licence.
E048	DOOR ABORTED EXPOSURE The door switch has been opened before the end of the exposure.
E049	COMMUNICATIONS ERROR The generator has lost the communications with the remote console.
E050	ABORTED EXPOSURE ERROR The user has released the exposure device/s before the end of the exposure (Prep and/or Exp).
E051	WRONG EXPOSURE TIME ERROR The exposure time is above the maximum (very unlikely) or it is so short that it is not reachable according to the present configuration (rise time and kVp decay/high voltage capacity).
E053	FLUORO SYNC ERROR The timeout for receiving the fluoro synchronism pulse has elapsed.
E054	DIGITAL SYNC ERROR The timeout for receiving the Digital/DSI synchronism pulse has elapsed.
E055	NOT ENOUGH DOSE ERROR The backup timer has elapsed before the AEC or the System has ended the exposure.
E056	NOT ENOUGH BACKUP TIME ERROR The backup timer has elapsed before the Tomograph ends the exposure.
E057	DUAL ENERGY ERROR It is not possible to load the Dual Energy parameters for the next exposure.
E058	TUBE1 DATA ERROR The tube data pointed by the tube 1 index are not defined, a default tube has been selected.
E059	TUBE2 DATA ERROR The tube data pointed by the tube 2 index are not defined, a default tube has been selected.

HF Series Generators

Troubleshooting

Table 4-1 (cont.)
Error code list

ERROR CODE	DESCRIPTION
E060	AUTOCAL ERROR The number of exposures to autocalibrate a mA station has run out.
E061	LICENCE ERROR There has been an error while trying to access the Licence data. Default options have been selected.
E062	AEC ERROR AEC selection error.
E063	ROTOR READY ERROR The Ready from the starter has been lost before the end of the exposure.
E064	TANK FEEDBACK ERROR The Feedback connector from the tank is not plugged in.
E065	+24V DELAYED POWER SUPPLY FAILURE +24V delayed power supply is out of range.
E066	+24V (UNR) POWER SUPPLY FAILURE +24V (unregulated) power supply is out of range.
E067	-15V POWER SUPPLY FAILURE -15V power supply is out of range.
E068	+3.3V POWER SUPPLY FAILURE +3.3V power supply is out of range.
E069	+24 PERMANENT (UNR) POWER SUPPLY FAILURE +24 permanent (unregulated) power supply is out of range.
E070	AEC RAPID TERMINATION Exposure was aborted because a lack of radiation received on the AEC.
E071	INTERLOCK ERROR Exposure was aborted because in interlock configured to abort exposures has been deactivated during the exposure.
E072	POSITIONER OK ERROR Exposure was aborted because the signal Positioner OK (configured to be used as an interlock) has been deactivated during the exposure.
E073	XON FEEDBACK ERROR Exposure was aborted because the signal XON Feedback has not been activated or has been deactivated during the exposure.
E074	COP GENERATOR RESET ERROR The generator has been reset because of the COP module.
E075	CLK GENERATOR RESET ERROR The generator has been reset because of the CLK module.
E076	TRAP GENERATOR RESET ERROR The generator has been reset because of an illegal operation code.
E077	SOFTWARE INTERRUPT GENERATOR RESET ERROR The generator has been reset because of a software interrupt.

Table 4-1 (cont.)
Error code list

ERROR CODE	DESCRIPTION
E078	MEMORY OVERFLOW INTERRUPT GENERATOR RESET ERROR The generator has been reset because of a memory overflow interrupt.
E079	REQUIRED mA STATIONS CAL ERROR The required mA stations have not been calibrated.
E091	HEARTBEAT ERROR (R2CP Protocol) The main controller is not receiving the Heartbeat messages within the configured timeout. R2CP (CAN) protocol functionality.
E099	INCORRECT MESSAGE Last message was not recognized as a SHFR protocol message.
E101	NO SPEED AVAILABLE The starter does not allow starting the tube neither in high speed nor in low one.
E102	LOW SPEED UNAVAILABLE The starter does not allow starting the tube in low speed.
E103	HIGH SPEED UNAVAILABLE The starter does not allow starting the tube in high speed.
E104	DOSIMETER TUBE 1 NO ANSWER ERROR The dosimeter of the tube 1 doesn't respond.
E105	DOSIMETER TUBE 1 TEST ERROR The dosimeter of the tube 1 didn't complete initialization test.
E106	DOSIMETER TUBE 1 STATUS ERROR The dosimeter of the tube 1 answered a wrong or unexpected status.
E107	DOSIMETER TUBE 2 NO ANSWER ERROR The dosimeter of the tube 2 doesn't respond.
E108	DOSIMETER TUBE 2 TEST ERROR The dosimeter of the tube 2 didn't complete initialization test.
E109	DOSIMETER TUBE 2 STATUS ERROR The dosimeter of the tube 2 answered a wrong or unexpected status.
E125 to E240	System failure related to the S0008009 Dual Speed Starter.

Note 

Depending on the device in which the error messages are displayed (Generator Console, Virtual Console (PC Workstation), Acquisition Software, etc.) different numbered codes may appear: E102, ER1102, 100002, Err 102....

4.1 MICRO-CONTROLLER HEXADECIMAL CODIFICATION OF ERRORS

The status of the Dual Speed Starter errors is always shown by groups of eight LEDs, present in the micro-controller (μ c) indicated below.

MICRO-CONTROLLERS	P/N	DIODES
Dual Speed Starter μ c	S0008009	D40-D42-D43-D46-D47-D48-D50-D49

Each LED counts as logical 0 when switched OFF and as 1 when switched ON.

The LEDs are split in two nibbles of three LEDs in the first one and four in the second one. Using the Hexadecimal codification it gets a code ranged from 00 to 7F (symbols 0 to 9 represent values zero to nine, and A to F represent values ten to fifteen).

Red LED ON means error and OFF means status.

Red LED ON and the remaining LEDs lighted means that the micro is held in reset.

If more than one error occurred, they are shown alternatively.

Illustration 4-1
Hexadecimal codification of errors example

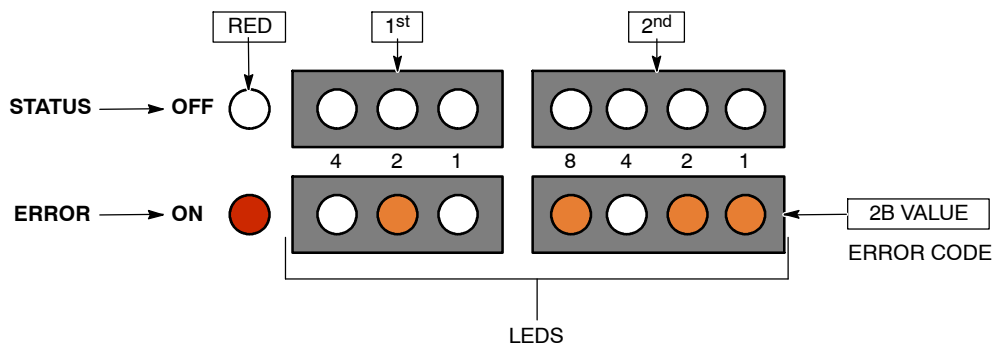
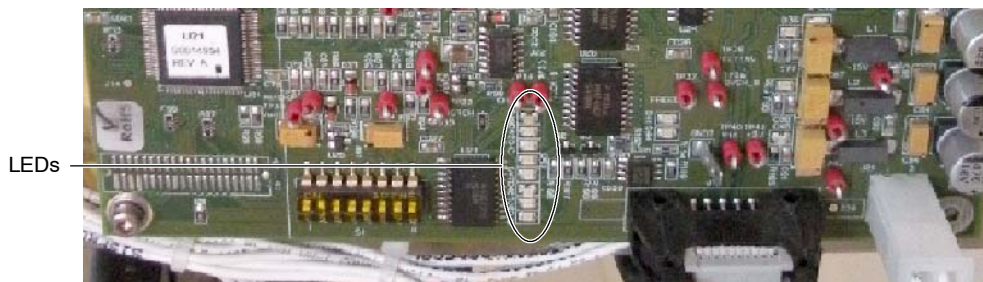


Illustration 4-2
Dual Speed Starter LEDs



4.2 SYSTEM ERRORS

ERROR CODE: E001 BACKUP TIMER — I2C ERROR

DESCRIPTION :	I2C Bus error while trying to access the external redundant backup timer.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	Anytime.

POSSIBLE CAUSES

It is not possible to communicate with the secondary microcontroller that works as the redundant backup timer.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists and it appears right after a service operation, verify that no device has been connected to J31 (I2C) of the A3640-XX Control board by mistake. If so, unplug it and reset the error.
3. If the error code remains, unplug the licence from J17, reboot the Generator and check again:
 - a. If E001 is replaced by E047 (Licence — I2C Error), replace the licence.
 - b. If E001 remains, replace the A3640-XX Control board.

ERROR CODE: E002 WRONG WS CONFIGURATION ERROR

DESCRIPTION :	One or more workstations are not properly configured; a default value has been assigned.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence or when pressing “Prep”.

POSSIBLE CAUSES

The workstation configuration is invalid. For example, a workstation configured as bucky/digital panel has no input selected.

Any workstation configuration is not allowed by the licence.

ACTIONS

1. Review the workstation configuration and correct the wrong value (*refer to the Configuration document*).
2. If the error persists, consider initializing the EEPROM (*refer to the EEPROM Initialization Section on the Configuration document*).

Note

If the EEPROM is initialized, the calibration data will be lost and the system configuration will be overwritten with the default values.

3. If the error persists once the EEPROM is initialized, replace the A3640-XX Control board.

ERROR CODE: E003 NO WS CONFIGURED ERROR

DESCRIPTION :	No tube has been configured for any of the workstations, there is no workstation available and a default value has been assigned.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence or when pressing “Prep”.

POSSIBLE CAUSES

The workstation configuration is invalid.

ACTIONS

1. Review the workstation configuration and configure at least one of them with a tube value different from '0'.
2. If the error persists, consider initializing the EEPROM (*refer to the EEPROM Initialization Section on the Configuration document*).

Note 

If the EEPROM is initialized, the calibration data will be lost and the system configuration will be overwritten with the default values.

3. If the error persists once the EEPROM is initialized, replace the A3640-XX Control board.

ERROR CODE: E004 FLUORO ORDER ERROR

DESCRIPTION :	The Fluoro order input signal is active during the startup sequence.
ERROR TYPE :	“Unrecoverable”, the system remains lock.
APPLICABLE TO :	“All Generators.
APPEARS WHEN :	During the startup sequence.

POSSIBLE CAUSES

Fluoro order has been accidentally activated during the startup sequence.
Defective hardware.

ACTIONS

1. Check that the external fluoro device (pedal, etc.) has not been accidentally activated during startup.
2. If the error persists, check the fluoro order input in J23.14 of the A3640-XX Control board (/FLUORO_ORDER_IN).
 - a. If the input signal is at a high logic level, replace the A3640-XX Control board.
 - b. If the input signal is at a low logic level, proceed with step 3. if the Generator is provided with the A3674-XX Interface board or proceed with step 4. if the Generator is not equipped with Interface board.

Note

Fluoro order (FLUORO_ORDER_IN on the A3640-XX Control board) is named P. FLUORO in the A3674-XX Interface board schematics.

3. Disconnect the device connected to TS1-39 of the A3674-XX Interface board and reboot the Generator.
 - a. If the error message disappears, check the device condition and replace it if necessary.
 - b. If the error persists, check the ribbon cable from J2 of the A3674-XX Interface board to J32 of the A3640-XX Control board and replace it if necessary.
 - c. If the ribbon cable is in proper condition and the error persists, replace the A3674-XX Interface board.
4. Disconnect the external fluoro device to isolate the source of the error to be able to verify the cause of the fluoro order activation.

ERROR CODE: E005 EXP ORDER ERROR

DESCRIPTION :	The Exposure order input signal is active during the startup sequence.
ERROR TYPE :	"Unrecoverable", the system remains lock.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.

POSSIBLE CAUSES

Exposure order has been accidentally activated during the startup sequence.
Defective hardware.

ACTIONS

1. Check that the external device which generates the Exposure order (handswitch, etc.) is not activated during startup.
2. If any device (handswitch) is connected to J14 of the A3640-XX Control board, disconnect it and reboot the Generator.
 - a. If the error message disappears, check the device condition and replace it if necessary.
 - b. If the error message persists and there is any device connected to J25 of the A3640-XX Control board, proceed with step 3. If no device is connected to J25, proceed with step 4. if the Generator is provided with the A3674-XX Interface board or proceed with step 6. if the Generator is not equipped with Interface board.
3. Check the Exposure order input in J25-10 (/EXP_EXT1) and J25-4 (EXP_EXT2) of the A3640-XX Control board.
 - a. If both signals are at a high logic level, replace the A3640-XX Control board.
 - b. If any of those signals is at a low logic level, check the device connected to it.

Note 

Exposure order is named EXP ORDER in TS1-5 of the A3674-XX Interface board.

4. Disconnect the device connected to TS1-5 of the A3674-XX Interface board and reboot the Generator.
 - a. If the error message disappears, check the device condition and replace it if necessary.
 - b. If the error message persists, proceed with step 5.
5. Disconnect J5 from the A3674-XX Interface board and test for electrical continuity between J5-15 and J5-14 of the cable.
 - a. If there is electrical continuity, check the cable, Control Console or handswitch for a short-circuit.
 - b. If there is not electrical continuity, check the ribbon cable from J2 of the A3674-XX Interface board to J32 of the A3640-XX Control board and replace it if necessary.
 - c. If the ribbon cable is in proper condition and the error persists, replace the A3674-XX Interface board.
6. Disconnect the external device to isolate the source of the error to be able to verify the cause of the exposure order activation.

ERROR CODE: E006 PREP ORDER ERROR

DESCRIPTION :	The Preparation order input signal is active during the startup sequence.
ERROR TYPE :	“Unrecoverable”, the system remains lock.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.

POSSIBLE CAUSES

Prep order has been accidentally activated during the startup sequence.
Defective hardware.

ACTIONS

1. Check that the external device which generates the Preparation order (handswitch, etc.) is not activated during startup.
2. If any device (handswitch) is connected to J14 of the A3640-XX Control board, disconnect it and reboot the Generator.
 - a. If the error message disappears, check the device condition and replace it if necessary.
 - b. If the error message persists and there is any device connected to J25 of the A3640-XX Control board, proceed with step 3. If no device is connected to J25, proceed with step 4. if the Generator is provided with the A3674-XX Interface board or proceed with step 6. if the Generator is not equipped with Interface board.
3. Check the Exposure order input in J25-11 (/PREP_EXT1) and J25-5 (PREP_EXT2) of the A3640-XX Control board.
 - a. If both signals are at a high logic level, replace the A3640-XX Control board.
 - b. If any of those signals is at a low logic level, check the device connected to it.

Note

Preparation order is named PREP ORDER in TS1-4 of the A3674-XX Interface board.

4. Disconnect the device connected to TS1-4 of the A3674-XX Interface board and reboot the Generator.
 - a. If the error message disappears, check the device condition and replace it if necessary.
 - b. If the error message persists, proceed with step 5.
5. Disconnect J5 from the A3674-XX Interface board and test for electrical continuity between J5-16 and J5-14 of the cable.
 - a. If there is electrical continuity, check the cable, Control Console or handswitch for a short-circuit.
 - b. If there is not electrical continuity, check the ribbon cable from J2 of the A3674-XX Interface board to J32 of the A3640-XX Control board and replace it if necessary.
 - c. If the ribbon cable is in proper condition and the error persists, replace the A3674-XX Interface board.
6. Disconnect the external device to isolate the source of the error to be able to verify the cause of the exposure order activation.

ERROR CODE: E007 TUBE2 MODEL ERROR

DESCRIPTION :	The tube index (related to a tube in the tube list) configured for the tube 2 is outside boundaries, a default value has been assigned.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.

POSSIBLE CAUSES

The tube model configuration is invalid.
The EEPROM is not initialized (not likely).
Corrupted data in the EEPROM.

ACTIONS

1. Open the Service Console and go to the Configuration screen. Index “1” is automatically selected in Tube 2 configuration but, in order to correctly set the Tube selection, do as follows:
 - a. If the Index to be selected is “1”, change the selection to any other number (2 to 8) and press on the “Store Data (In SHFR)” button. Then, select Index “1” and press on the “Store Data (In SHFR)” button again.
 - b. If the Index to be selected should be different to “1”, change the selection to the correct Index and press on the “Store Data (In SHFR)” button.
2. If the error persists, consider initializing the EEPROM (*refer to the EEPROM Initialization Section on the Configuration document*).

Note 

If the EEPROM is initialized, the calibration data will be lost and the system configuration will be overwritten with the default values.

ERROR CODE: E008 TUBE1 MODEL ERROR

DESCRIPTION :	The tube index (related to a tube in the tube list) configured for the tube 1 is outside boundaries, a default value has been assigned.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.

POSSIBLE CAUSES

- The tube model configuration is invalid.
- The EEPROM is not initialized (not likely).
- Corrupted data in the EEPROM.

ACTIONS

1. Open the Service Console and go to the Configuration screen. Index “1” is automatically selected in Tube 1 configuration but, in order to correctly set the Tube selection, do as follows:
 - a. If the Index to be selected is “1”, change the selection to any other number (2 to 8) and press on the “Store Data (In SHFR)” button. Then, select Index “1” and press on the “Store Data (In SHFR)” button again.
 - b. If the Index to be selected should be different to “1”, change the selection to the correct Index and press on the “Store Data (In SHFR)” button.
2. If the error persists, consider initializing the EEPROM (*refer to the EEPROM Initialization Section on the Configuration document*).

Note

If the EEPROM is initialized, the calibration data will be lost and the system configuration will be overwritten with the default values.

ERROR CODE: E009 INVERTER ERROR (IGBT FAULT)

DESCRIPTION :	The inverter module has been overloaded.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the exposure and when pressing "Prep"/Fluoro pedal.
INFORMATION/SYMP TOM :	This error may appear at the Console as "E009" error code or as "Generator Overload" indication. During exposure an overcurrent on the IGBTs of the HV Inverter Module has been detected. This may be produced by an arc or malfunction on the HV Circuitry.

POSSIBLE CAUSES

- Defective X-ray Tube.
- Defective HV Transformer or HV Cable.
- Defective Inverter Module.
- Defective A3640-XX Control board.
- Extremely high Duty Cycle on Rad and Fluoro operation.

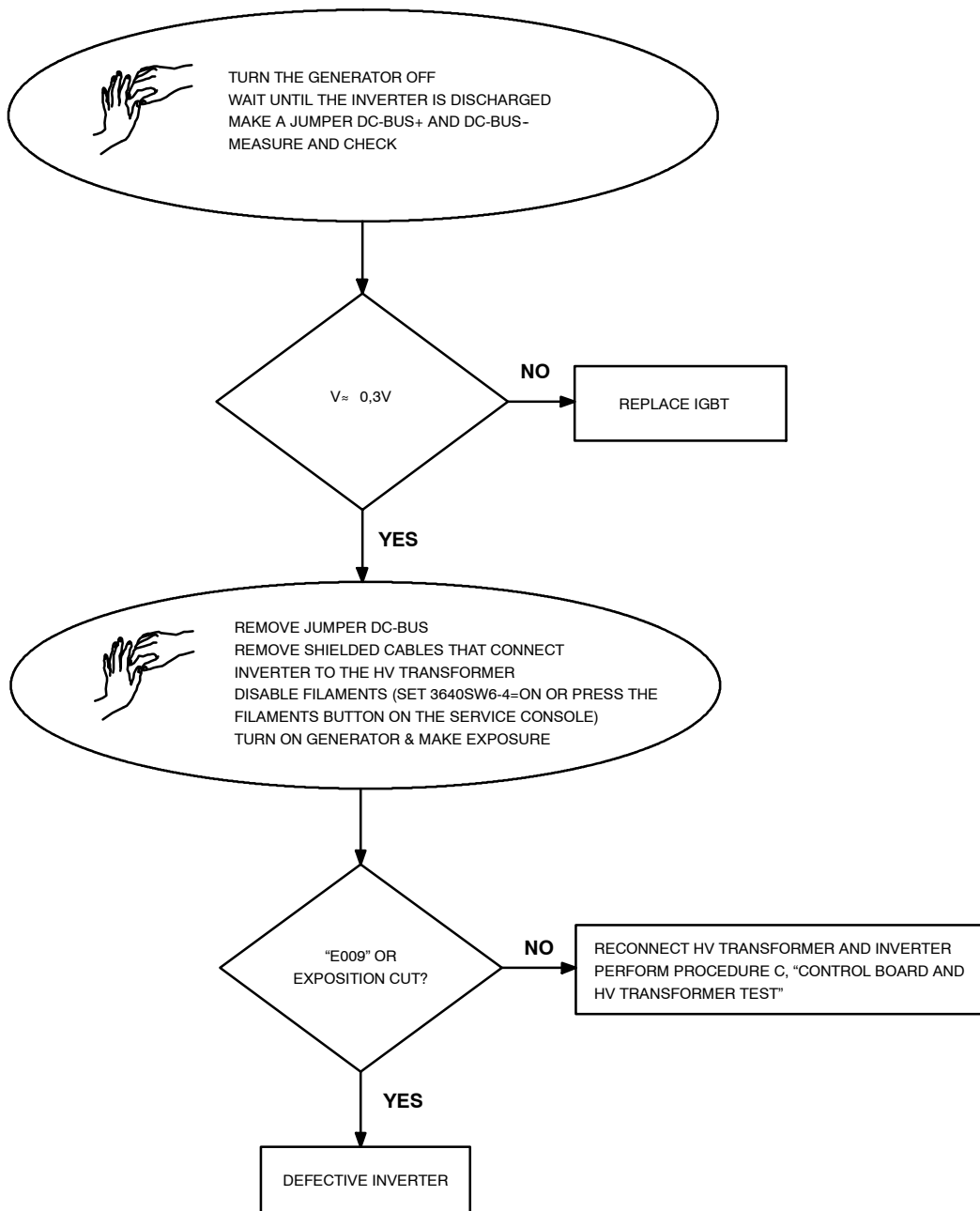
ACTIONS**A. PRELIMINARY**

1. Select minimum kVp, minimum mA, and 80 ms (for example 40 kVp, 10mA, and 80 ms). Make preparation and check that anode rotates in the X-ray Tube. If the anode is not rotating correctly, check the starter and the Stator connections.
2. In case the anode is rotating correctly, make an exposure:
 - If "E009" or "Generator Overload" appears, follow the procedure in paragraph B, "Inverter Module Test".
 - If not, follow step 3.
3. Increment kVp in 10 kVp steps, select the same mA and time. Make an exposure:
 - If "E009" or "Generator Overload" appears, or the exposure is cut before 80 ms, then follow Procedure C, "Control board and HV Transformer Test".
 - If not, keep on increasing the kVp in 10 kVp steps (60, 70, 80, 90, 100, 110, 120 and 125 kVp for 125 kVp HV Transformers; and 130, 140 and 150 kVp for 150 kVp HV Transformers) making Exposures at each kVp selected.
 - If "E009" or "Generator Overload" appears, or the exposure is cut before 80 ms at any kVp selected, follow Procedure C, "Control board and HV Transformer Test".
 - If "E009" or "Generator Overload" has not appeared at the maximum kVp or the exposure was not cut before 80 ms, it means that the HV Transformer and the HV Cables are OK. Then follow Procedure F, "RANDOM 'E009' or 'Generator Overload'". In this case high mA causes "E009" or "Generator Overload".

B. INVERTER MODULE TEST

Illustration 4-3 shows a Flowchart for Procedure B.

Illustration 4-3
Flowchart for B: Inverter Module Test



1. Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF.
2. Remove the covers from the Generator Cabinet.
3. Wait for the DC Bus of the Inverter to be fully discharged. When it is fully discharged the LEDs on the Charge/Discharge board will be completely turned off.



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 ARE OFF BEFORE SERVICING THE EQUIPMENT (APPROX. 3 MINUTES AFTER THE UNIT IS TURNED OFF).

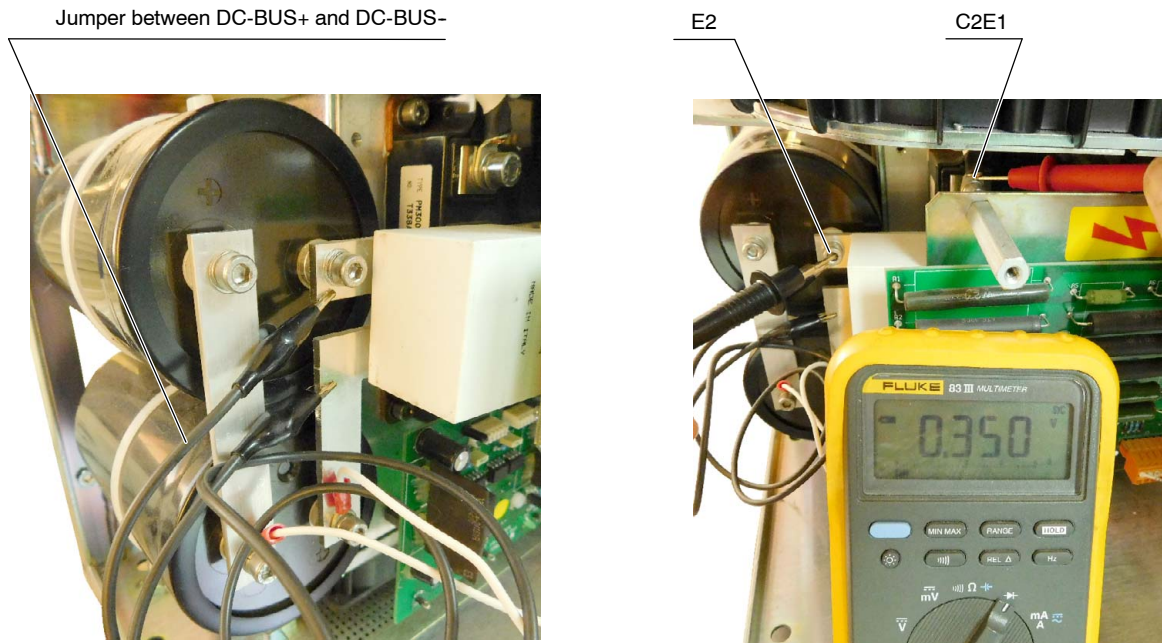
4. When LEDs are off make a jumper between DC-BUS+ and DC-BUS- (use a wire AWG 22 [0.5 mm²] or higher). Make sure that there is less than 10 V_{DC} across the BUS. (*Refer to Illustration 4-4 to see where to make the jumper.*)
5. Measure with a Multimeter in Diode (or ohms) between C2E1 (positive polarity) and E2 or C1 (negative polarity) in both IGBTs (*refer to Illustration 4-4 for more details*). Repeat the measure with different polarity between C2E1 (negative polarity) and E2 or C1 (positive polarity).

The voltage should be around 0.3 V (or the resistance must be a high impedance) for the IGBT to be OK. Normally when an IGBT is broken the voltage is = 0 volts (or the resistance is zero [0] Ohms) or very close.

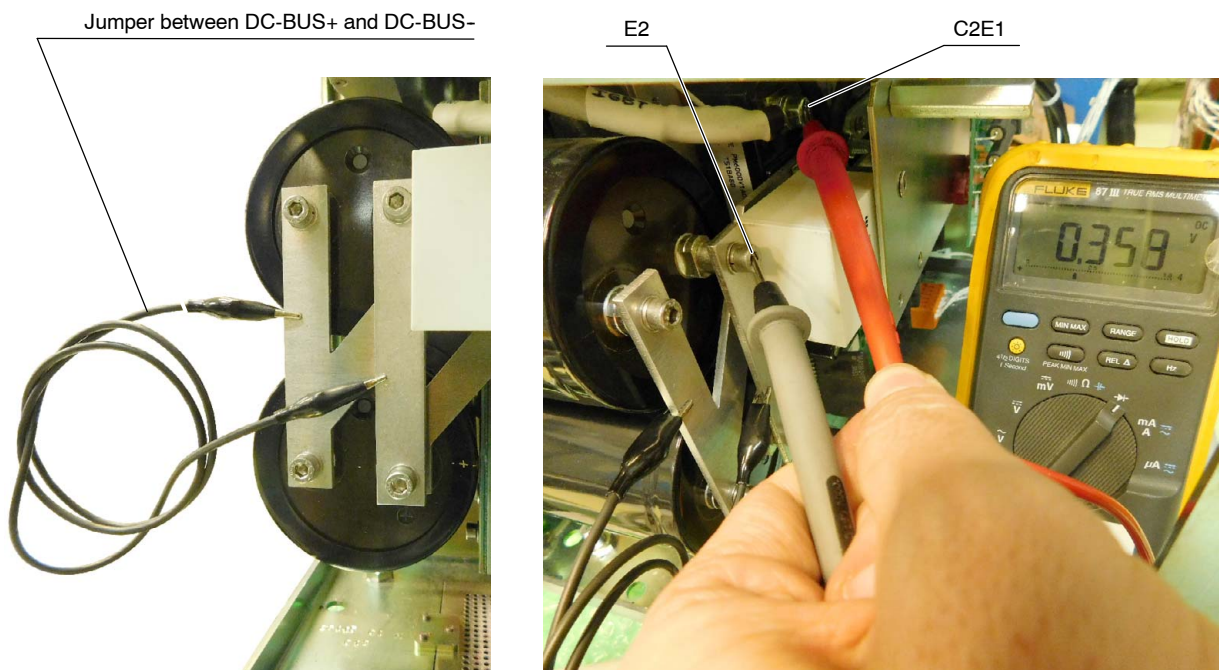
HF Series Generators

Troubleshooting

Illustration 4-4
Jumper and Measurement Points



3-PHASE LINE POWERED GENERATOR



1-PHASE LINE POWERED GENERATOR OR BATTERY POWERED GENERATOR

6. Repeat the measurements done in step 5. for the other IGBT.



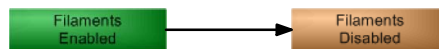
DON'T FORGET TO REMOVE THE JUMPER ACROSS THE DC BUS AFTER ALL MEASUREMENTS ARE MADE, OTHERWISE THE INVERTER WILL SUFFER SERIOUS DAMAGE.

7. If any of the IGBTs are short-circuited, replace the IGBT.
8. If both IGBTs are OK, remove both shielded cables that connect the Inverter to the HV Transformer: P1, P3, and SHLD (P2). Isolate the three (3) wires completely from each other and from the metal sheet or ground.



MAKE SURE THE WIRES ARE PERFECTLY ISOLATED AND THAT NO SHORT-CIRCUIT IS MADE, OTHERWISE SERIOUS DAMAGES COULD RESULT.

9. Turn the Room Electrical Cabinet (Mains Disconnect) and Generator ON.
10. Set dip switch 3640SW6-4 on the A3640-XX Control board to **On** (disables Filaments) or press the Filaments button on the Service Console menu to disable the Filaments by software.



11. Make an exposure:
 - If "E014" appears, go to steps 12., 13. and 14. Then, follow Procedure C, "Control board and HV Transformer Test".
 - If "E009" or "Generator Overload" appears, replace the whole Inverter Module.
12. Set DIP switch 3640SW6-4 on the A3640-XX Control board to **Off** or press the Filaments button on the Service Console menu to enable the Filaments by software, depending on the action performed before on step 10.
13. Turn the Electrical Room Cabinet (Main Disconnect) and generator OFF. Wait three (3) minutes for the Main Storage Capacitors to discharge.
14. Re-connect both shielded cables that connect the Inverter to the HV Transformer P1, P3, and SHLD (P2).

C. CONTROL BOARD AND HV TRANSFORMER TEST3

1. Make these connections with the Oscilloscope:
 - CH.1 on mA+ (TP56) on the Control board.
 - CH.2 on mA- (TP59) on the Control board.
 - Base Time in 10 ms per division and 1 V per division
2. Turn the mains and Generator ON.
3. Select 40 kVp, 10mA, and 80 ms. Make an exposure and check that both waveforms are almost symmetric (a difference of 12% is normal).
 - If it is OK, follow the procedure in step 4.
 - If it is not OK, check:
 - that in the mA test point of the A3640-XX Control board (TP85 and TP86) the jumper is correctly placed and secure.
 - that connector J1 is correctly placed and secure in the HV Transformer.
 - continuity between the HV Transformer and the Control board in J1-B and J18.2, J1-C and J18.1, J1-M and J18.6, and J1-R and J18.3. Check that they are correctly connected and secure.
 - if after these actions the waveform is not OK, replace the A3640-XX Control board.
4. Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF. Wait three (3) minutes for the Main Storage Capacitors to discharge.
5. Remove the HV Cables from the HV Transformer (anode and cathode) and fill the HV Receptacles with oil.

Note

Exposures up to 90 kVp can be made without filling the HV Receptacles with oil.

6. Turn the Electrical Room Cabinet (Main Disconnect) and Generator ON.
7. Make these connections with the Oscilloscope:
 - CH.1 on kV+ (TP42) on the Control board.
 - CH.2 on kV- (TP51) on the Control board.
 - Base time in 25 ms per division and 0.5 V per division.
8. Select 40 kVp, 10 mA, and 80 ms. Make an Exposure and check that both waveforms are symmetric. A difference of 12% is normal.
 - If it is OK, follow procedure in step 9.
 - If it is not OK, follow Procedure D, "Asymmetry on the kVp Loop".

- Make exposures from 50 kVp to 140 kVp with the same Exposure Time and check that all kVp waveforms are symmetric and the values are similar according to the table below.

Select	TP42 & TP51 on the Control board
50 kVp	2.2 V
70 kVp	3.0 V
90 kVp	3.9 V
110 kVp	4.7 V
125 kVp	5.3 V
130 kVp	5.6 V
140 kVp	6.0 V

Note 

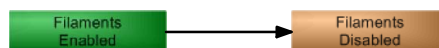
kV drop is slow due to the lack of charge.

- If the waveforms are not symmetric (within 12% at any point), follow Procedure D, "Asymmetry on the kVp Loop".
- If everything is OK, it means that HV Transformer is OK and the problem could be in the X-ray Tube or in the HV Cables. In order to determine exactly what part must be replaced (the X-ray Tube or the HV Cables) it is necessary to replace one of both components and perform the procedure again. In most of the cases the part to be replaced usually is the X-ray Tube. To know when the Tube begins to arc follow Procedure E, "X-ray Tube Test".
- Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

D. ASYMMETRY ON THE kVp LOOP

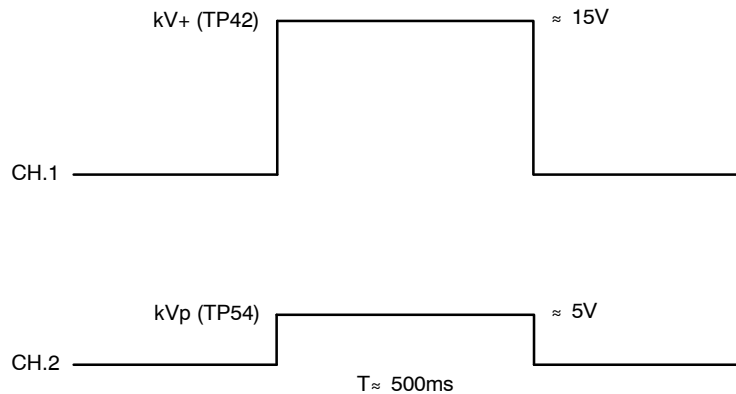
This procedure determines what part should be replaced due to asymmetry on the kVp Loop: the High Voltage Transformer or the A3640-XX Control board.

- Set dip switch 3640SW6-4 on the A3640-XX Control board to **On** (disables Filaments) or press the Filaments button on the Service Console menu to disable the Filaments by software.

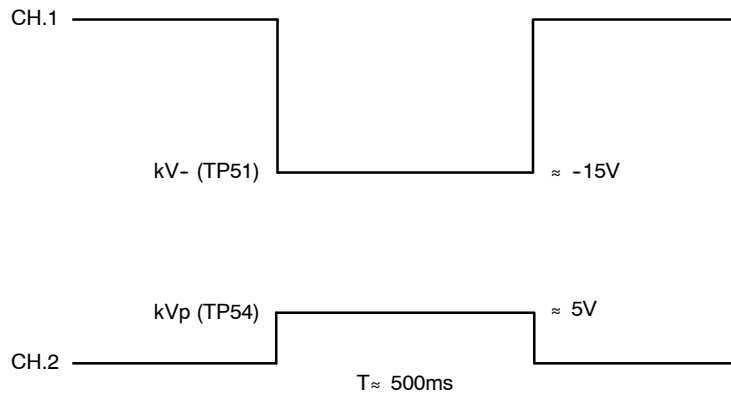


- Make these connections with the Oscilloscope:
 - CH.1 on kV+ (TP42) on the Control board.
 - CH.2 on kVp (TP54) on the Control board.
- Apply +15V (TP2 on the Control board) to kV+ (J18.2 on the Control board) for 500 ms. This operation may cause Error "020" if the voltage is applied for more than 500 ms. In this case, press reset to restore the error code.

4. Check the waveform's result:



- If it is OK, follow the procedure in step 5.
 - If it is not OK, replace the A3640-XX Control board. It is recommended to perform Procedure C, "Control board and HV Transformer Test", again.
5. Make these connections with the Oscilloscope:
- CH.1 on kV- (TP51) on the Control board.
 - CH.2 on kVp (TP54) on the Control board.
6. Apply -15V (TP1 on the Control board) to kV- (J18.1 on the Control board) for 500 ms. This operation may cause Error "020" if the voltage is applied for more than 500 ms. In this case, press reset to restore the error code.
7. Check the waveform's result:



- If it is OK, replace the HV Transformer.
 - If it is not OK, replace the A3640-XX Control board. It is recommended to perform Procedure C, "Control board and HV Transformer Test", again.
8. Set DIP switch 3640SW6-4 on the A3640-XX Control board to **Off** or press the Filaments button on the Service Console menu to enable the Filaments by software, depending on the action performed before on step 1.
9. Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

E. X-RAY TUBE TEST

After the performance of the above referred test everything is found OK, the Service (Field) Engineer may want to know the actual status of the Tube. Perform the following procedure in order to determine the point in which the X-ray Tube begins to arc.



It is strongly recommended to replace the Tube as soon as possible to prevent potential damage to the Generator.

1. Select 40kVp, 10mA, and 100 ms.
2. Make an exposure.
3. Increment kVp in 10 kVp steps, select same mA and time. Make an exposure.
 - If "E009" or "Generator Overload" appears follow Procedure C, "Control board and HV Transformer Test", if it has not been performed before. If Procedure C has been already performed follow the procedure in step 4.
 - If "E009" or "Generator Overload" does not appear, keep on incrementing the kVp in steps of 10 kVp (up to the maximum kVp), making exposures at each kVp selected.
 - If "E009" or "Generator Overload" appears at any kVp selected it means that the Tube has dielectric problems above the selected kVp.
 - If "E009" or "Generator Overload" does not appear (up to maximum kVp), it means that arcing may be due to mA or kW. Follow the procedure in step 4.
4. Select 40 kVp and 10 mA. Increment the mA one station and make an Exposure. Keep on incrementing the mA station (making exposures) until "E009" or "Generator Overload" appears. This will give an idea of the maximum mA allowed by the Tube without arcing. If "E009" or "Generator Overload" does not appear follow step 5.
5. If the Tube still does not arc, the problem is related to $kW = KV * mA$. Make selections on the Console at 100 ms incrementing kV and mA. A point will be reached in which "E009" or "Generator Overload" will appear. This will give an idea on the approximate value of kVp and mA that can be handled by the X-ray Tube. Also, this value may change when the Tube heats up.

F. RANDOM "E009" OR "GENERATOR OVERLOAD"

If everything is OK and random "E009" or "Generator Overload" appears, check:

1. That the signal IGBT FAULT on TP93 on the Control board is not low (logic 0) in stand-by and during the exposure. If there is noise, check for a loose connection between J5.4 on the Control board and J3.3 on the IPM Driver Board.
2. If IGBT FAULT is active during an exposure, try to isolate when it occurs. It may be due to noise coming from any device outside the Generator or it may occur when selecting a high power Exposure and the voltage of the main line goes down more than 10%.

ERROR CODE: E010 EEPROM CHECK ERROR

DESCRIPTION :	Erroneous data stored in the EEPROM.
ERROR TYPE :	"Unrecoverable", the system remains lock.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The EEPROM is not initialized.
- The EEPROM is defective.

ACTIONS

1. If the EEPROM has been replaced, reset the error code.
2. Turn the Generator OFF and ON again.
3. If the error does not reset, initialize the EEPROM (*refer to the EEPROM Initialization Section on the Configuration document*).
4. If the error persists, replace the EEPROM (U66).

Note

If the EEPROM is initialized, the calibration data will be lost and the system configuration will be overwritten with the default values.

ERROR CODE: E011 LOAD CAPACITOR ERROR

DESCRIPTION :	No voltage in the Main Storage Capacitors of the Generator (Inverter Module).
ERROR TYPE :	"Unrecoverable", the system remains lock.
APPLICABLE TO :	All Line or Battery Powered Generators.
APPEARS WHEN :	Only during initialization phase or when pressing "Prep".

POSSIBLE CAUSES

No voltage in the Main Storage Capacitors (C1, C2, C3, C4) of the Generator (Inverter Module).
Defective Charge/Discharge board.
Precharge K2 contactor located inside the Generator Cabinet is not energized.
Main line fuse F3 is blown (only for Line Powered Generators).
Main Battery fuses F1 and/or F2 are blown (only for Battery Powered Generators).
"/CHRG" signal of Pin 1 on connector J6 of the A3640-XX Control board is not correct.
Cables disconnected accidentally or damaged connectors.

ACTIONS**Note** 

Due to Error 11, main Contactors will remain in the following state:

K2: *It is connected during the precharge of the Inverter and disconnected again when error 11 is detected.*

K3: *It is never activated when error 11 appears.*

K2 Contactor disconnection can modify the initial measurements conditions due to the Inverter Module discharge. For accurate results, it is mandatory to perform the visual checks and measurements right after powering on the Generator.

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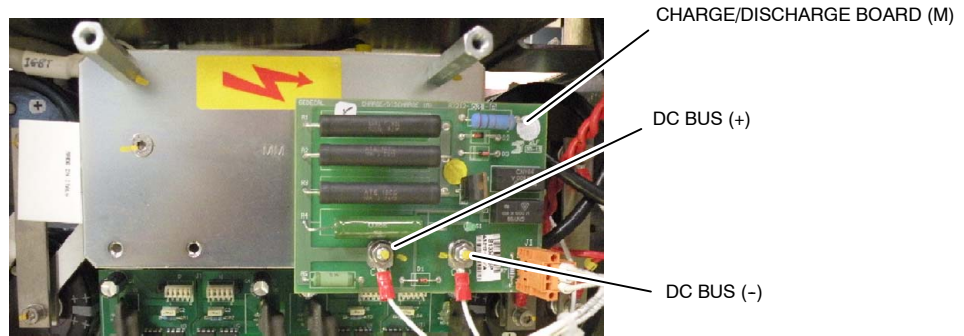
Troubleshooting

A. IF LED DS1 [CHARGE/DISCHARGE BOARD (M)] OR LEDS DS1 AND DS2 [CHARGE/DISCHARGE BOARD (T)] IS/ARE ILLUMINATED (LINE OR BATTERY POWERED GENERATOR)

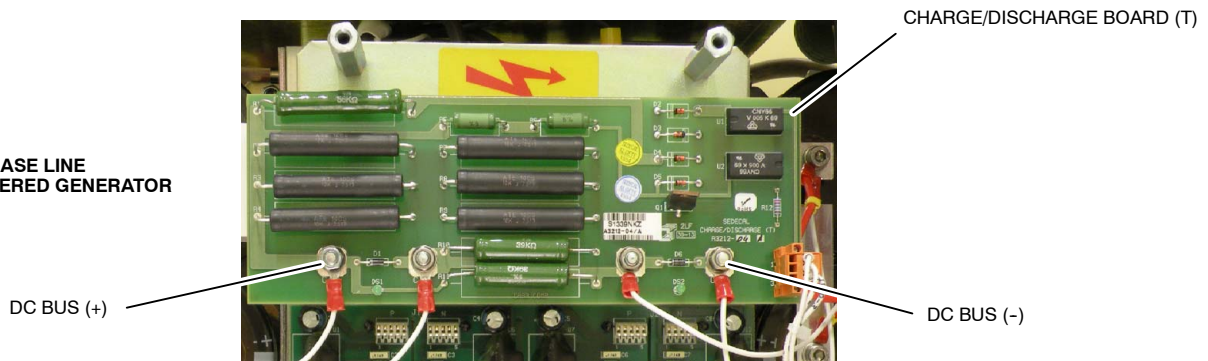
Check the voltage at the Main Storage Capacitors (C1, C2, C3, C4) (Inverter Module) measuring the voltage between DC BUS (+) and DC BUS (-) as indicated in the illustration below.

Illustration 4-5
Charge/Discharge board

1-PHASE LINE or BATTERY POWERED GENERATOR



3-PHASE LINE POWERED GENERATOR



The voltage at the Main Storage Capacitors should be the voltage of the Input Power Line multiply by 1.414 for Line Powered Generators (not in "Prep") ($\pm 10\%$). See the following examples:

Input Power Line	Voltage at the Main Storage Capacitors
Line Powered Generator at 230 V~	$230 \times 1.414 = 325 \text{ V}^{\text{DC}} (\pm 10\%)$
Line Powered Generator at 400 V~	$400 \times 1.414 = 566 \text{ V}^{\text{DC}} (\pm 10\%)$
Line Powered Generator at 480 V~	$480 \times 1.414 = 679 \text{ V}^{\text{DC}} (\pm 10\%)$
Battery Powered Generator at any Power Line	approx. $400 \text{ V}^{\text{DC}} (\pm 10\%)$ with all batteries fully charged.

- If the voltage is OK, check that J6.1 (/CHRG) on the A3640-XX Control board is at logic level "0". (0.15 V).
 - If logic level is OK (logic level 0), replace the A3640-XX Control board.
 - If logic level is not OK, check the link between J6.1 on the A3640-XX Control board and J1.1 on the Charge/Discharge board and between J6.3 on the A3640-XX Control board and J1.3 on the Charge/Discharge board.
 - If these links are OK, replace the defective Charge/Discharge board.
 - If they are not OK, repair connection.
- If the voltage in the Capacitors is not OK (be aware that the voltage must have been measured right after powering on the Generator), check the V~ on AC1 and AC2 (**for 3-phase Generators**) or AC1 and AC3 (**for 1-phase Generators**) at the Input Rectifier Board (**for Battery Powered Generators**: check the battery voltage). Reboot the Generator using the Control Console, the Tech Service Console or pressing SW3 on the A3640-XX Control board (*refer to the Configuration document*).
 - If the V~ is not OK, verify input connections and input fuses.
 - If the V~ is OK, disconnect BUS+ and BUS- at the Input Rectifier Board and check the V===.
 - If the V=== is not OK, replace any defective components (CR1, CR2, CR3) at the Input Rectifier Board.
 - If the V=== is OK, check for and replace any defective components at the Generator Cabinet.

B. IF LED DS1 [CHARGE/DISCHARGE BOARD (M)] OR DS1 AND DS2 [CHARGE/DISCHARGE BOARD (T)] IS/ARE NOT ILLUMINATED AND IT IS A NON-BATTERY POWERED GENERATOR

For 3-phase Generators, start the procedure in step 1. For 1-phase Generators, start in step 4.

1. Check the input V~ on the Generator (L1, L2 and L3).
 - If the input V~ is not correct, check the V~.
 - If the input V~ is correct, proceed with step 2.
2. Check the input V~ on LF1 (L1, L2 and L3).
 - If the input V~ is not correct, check fuse F3 and the connections from the fuses to LF1.
 - If the input V~ is correct, proceed with step 3.
3. Check the output V~ on LF1 (L1', L2', L3').
 - If the output V~ is not correct, replace LF1 filter.
 - If the output V~ is correct, proceed with step 4.
4. Check the input V~ on K2 [L1, L2 (and L3 in case of 3-phase Generators)].
 - If the input V~ is not correct, check and repair connections between LF1 and K2.
 - If the input V~ is correct, proceed with step 5.
5. Connect the voltmeter between T1 and T3 of K2 (**for 3-phase Generators**) or T1 and T2 (**for 1-phase Generators**).
6. Reboot the Generator using the Control Console, the Tech Service Console or pressing SW3 on the A3640-XX Control board (*refer to the Configuration document*).
7. Check if the line voltage is present during 3 seconds approx. before the error is detected.
 - If the line voltage is present, proceed with step 8.
 - If the line voltage is not present, proceed with step 9.

8. Check the pre-charge resistance R1 (20 Ω , 100 W).
 - If the pre-charge resistance is defective, replace it. (**refer to procedure B.1.**)
 - If the pre-charge resistance is correct, check the following links:
 - K2-T1 — AC1-CR1 of the A3255-XX Input Rectifier board
 - K2-T3 — K3-L3 (**only for 3-phase Generators**)
 - K2-T2 — K3-L2 (**only for 1-phase Generators**)
 - If the previous links are not correct, repair them.
 - If the previous links are OK, check/replace CR1, CR2 and CR3 rectifiers of the Power Inverter.
9. Check if K2 has been energized during 3 seconds approx. after powering on the Generator, before the error is detected. To do so, reboot the Generator.
 - If K2 has been energized, replace it.
 - If K2 has not been energized, proceed with step 10.
10. Check for 24 V $\overline{=}$ between A1 and A2 on K2 for 3 seconds during the start up.
 - If 24 V $\overline{=}$ are present, replace K2.
 - If 24 V $\overline{=}$ are not present, proceed with step 11.
11. Check the voltage (24 V $\overline{=}$) between K2-A1 and GND. It is not necessary to reboot the Generator for this measurement.
 - If this measurement is correct, proceed with step 12.
 - If this measurement is not correct, proceed with step 13.
12. Reboot the Generator and check if LED DS5 of the A3640-XX Control board is lighted for 5 seconds approx. during the start up.
 - If DS5 is not lighted, replace the A3640-XX Control board.
 - If DS5 is lighted, connect the voltmeter between J4.4 (/LINE CONT) and GND on the A3640-XX Control board. Reboot the Generator and check that the voltage goes from 24 V $\overline{=}$ to 0 V $\overline{=}$ when DS5 is lighted during the start up.
 - If the voltage goes from 24 V $\overline{=}$ to 0 V $\overline{=}$, check/replace the connection between J4.4 of the A3640-XX Control board and K2-A2.
 - If the voltage does not go from 24 V $\overline{=}$ to 0 V $\overline{=}$, replace the A3640-XX Control board.
13. Check the voltage (24 V $\overline{=}$) between TP1 and GND (TP8, TP9, TP10, TP11) on the A3646-XX Supply board.
 - If the voltage is correct, proceed with step 14.
 - If the voltage is not correct, proceed with step 15.
14. Check the voltage (24 V $\overline{=}$) between J4.3 and GND on the A3640-XX Control board.
 - If the voltage is correct, check/repair the connection between J4.3 of the A3640-XX Control board and K2-A1.
 - If the voltage is not correct, check the connection between J6.5 of the A3646-XX Supply board and J3.5 of the A3640-XX Control board.
 - If the connection is not correct, repair it.
 - If the connection is correct, replace the A3646-XX Supply board.
15. Check the voltage (24 V $\overline{=}$) between K1-23 and GND.
 - If the voltage is correct, check/repair the connection between K1-23 and J13.2 of the A3646-XX Supply board.
 - If the voltage is not correct, proceed with step 16.

16. Check the voltage (24 V \approx) between K1-24 and GND.
 - If the voltage is correct, replace K1.
 - If the voltage is not correct, verify/repair connection between K1-24 and J13.1 of the A3646-XX Supply board.

B.1. IF THE PRE-CHARGE RESISTANCE IS DEFECTIVE

1. Check that there is no short-circuit on the Power Inverter rectifier input. For that purpose, measure between AC1-CR1, AC2-CR2 (and AC3-CR3 for 3-phase Generators).
2. Check that there is no short-circuit on the Power Inverter rectifier output. For that purpose, measure between DC BUS (+) and DC BUS (-).
3. Once the R1 resistance has been replaced, and considering that Error 11 does not appear anymore, check that contactor K3 is energized approx. 5 seconds after K2 during the start up.
 - If K3 is energized, verify that contacts L2-T2 (1-phase) or L3-T3 (3-phase) are closed by checking that the voltage disappears when K3 is energized.
 - If the contacts are closed, no further actions are needed.
 - If the contacts are not closed, replace K3.
 - If K3 is not energized, check the voltage (24 V \approx) between A1 and A2 of K3.
 - If the voltage is OK, replace K3.
 - If the voltage is not OK, proceed with step 4.
4. Check the voltage (24 V \approx) between A1 and GND.
 - If the voltage is not OK, check/repair the connection between K2-A1 and K3-A1.
 - If the voltage is OK, check if the DS11 LED of the A3640-XX Control board is lighted.
 - If DS11 is not lighted, replace the A3640-XX Control board.
 - If DS11 is lighted, check/repair the connection between K3-A2 and J4.2 of the A3640-XX Control board.

C. IF LED DS1 IS NOT ILLUMINATED AND IT IS A BATTERY POWERED GENERATOR.

1. Check for battery voltage (\approx 400 V \approx , depending on the charge level) on K2 between L1 (BAT +) and L2 (BAT -).
 - If the voltage is not present, disconnect the Anderson connector J1 and verify that the batteries voltage is present in the part of J1 that comes from the batteries.
 - If the voltage is not present, check the connection of the J1 Anderson connector and the internal connections of the battery trays.
 - If the voltage is present, check fuses F1 and F2 and the connections from J1 to the fuses and from the fuses to K2 contactor (L1 and L2).
 - If the voltage is present, connect the voltmeter between T1 and T2 of K2. Reboot the Generator using the Tech Service Console or pressing SW3 on the A3640-XX Control board (*refer to the Configuration document*) and check if the battery voltage is present for about 3 seconds right after powering up the Generator, before the error is detected.
 - If the voltage is not present, proceed with **step 9. of procedure B.**
 - If the voltage is present, proceed with step 2.

2. Check the pre-charge resistance R1 (20 Ω , 100 W).
 - If the resistance is correct, check and repair the following connections:
 - K2-T1 — Power Inverter
 - K2-T2 — K3-L2
 - K3-T2 — Power Inverter
 - If the resistance is not correct, replace it and **follow procedure C.1.**

C.1. IF THE PRE-CHARGE RESISTANCE IS DEFECTIVE

1. Check that there is no short-circuit on the Power Inverter. For that purpose, measure between DC BUS (+) and DC BUS (-).
2. Once the R1 resistance has been replaced, and considering that Error 11 does not appear anymore, check that contactor K3 is energized approx. 5 seconds after K2 during the start up.
 - If K3 is energized, verify that contacts L2-T2 are closed by checking that the voltage disappears when K3 is energized.
 - If the contacts are closed, no further actions are needed.
 - If the contacts are not closed, replace K3.
 - If K3 is not energized, check the voltage (24 V \approx) between A1 and A2 of K3.
 - If the voltage is OK, replace K3.
 - If the voltage is not OK, proceed with step 3.
3. Check the voltage (24 V \approx) between A1 and GND.
 - If the voltage is not OK, check/repair the connection between K2-A1 and K3-A1.
 - If the voltage is OK, check if the DS11 LED of the A3640-XX Control board is lighted.
 - If DS11 is not lighted, replace the A3640-XX Control board.
 - If DS11 is lighted, check/repair the connection between K3-A2 and J4.2 of the A3640-XX Control board.

ERROR CODE: E012 mA RANGE ERROR

DESCRIPTION :	Tube current out of range during exposure.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During exposure.

POSSIBLE CAUSES

- HV cables are swapped.
- The filament current demand is not calibrated properly.
- Defective filament control hardware.
- Fault/noise in the mA measure.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check the connection of the Anode and Cathode cables from the HV Transformer to the X-ray Tube, making sure they are connected to the corresponding receptacles.
 - If the HV cables are not properly connected, connect the cables correctly, maintaining correct Anode and Cathode orientation.
 - If the Tube connections are correct and the error persists, proceed with step 3.
3. Check that the Anode cable is correctly inserted into the receptacle socket and its ring nut is tightened; and that the Cathode cable is not shorted.
 - If the High Voltage cables are defective, repair them.
 - If the High Voltage cables are correct, proceed with step 4.
4. Check the "Filament Data Graph" in the Service Console.
 - If there are no Filament curves drawn in the graph, calibrate the X-ray Tube.
 - If there are Filament curves, proceed with step 5.
5. Check the Filament Current data of the mA station(s) that are selected when Error 12 is displayed.
 - If the Filament Current data is set to "1000", calibrate it (*refer to the Calibration document*).
 - If the Filament Current data is other than "1000", proceed with step 6.
6. Check that "Prep" can be pressed without the need of pressing "Exp".
 - If "Prep" cannot be pressed independently of pressing "Exp", check "Boosting Time" and "Filament Setting Time" in the Configuration screen of the Service Console.
 - If any or both of the fields are not properly configured, change their value (*refer to the Configuration document*).
 - If they are properly configured, proceed with step 10.
 - If "Prep" can be pressed independently of pressing "Exp", proceed with step 7.

Note 

Minimum exposition time to detect Error 12 is 40ms.

7. Press "Prep" during 5 seconds and, then, press "Exp".
 - If Error 12 is displayed, proceed with step 10.
 - If Error 12 is not displayed, set the "Filament Setting Time" to "2700" in the Configuration screen of the Service Console and try again.
 - If Error 12 is displayed, set the "Filament Setting Time" to the previous value, and proceed with step 10.
 - If Error 12 is not displayed, proceed with step 8.
8. Adjust the "Filament Setting Time" to the required value and open the Exposure Scope of the Service Console to check mA (*refer to the Calibration document*).
9. In order to verify that the problem has disappeared:
 - a. Select the highest mA station for Small Focus and the lowest kVp allowed for this mA station. Make an exposure by pressing at the same time the "Prep" and "Exp" controls; check that the mA reading at the beginning of the exposure is correct.
 - b. Select the highest mA station for Large Focus and the lowest kVp allowed for this mA station. Make an exposure by pressing at the same time the "Prep" and "Exp" controls; check that the mA reading at the beginning of the exposure is correct.
 - c. Calibrate the Filament Current data, if necessary.
10. Select 80 kVp and a mA station which causes Error 12; and make an exposure.
 - If Error 12 is not displayed, check the Filament Current data of the mA stations that cause the error and calibrate them, if necessary.
 - If Error 12 is displayed, proceed with step 11.
11. Remove the jumper between TP85 and TP86 and connect a mAs meter.
12. Open the Exposure Scope and the Manual Calibration screen of the Service Console.
13. Select 80 kVp and a mA station which causes Error 12.
14. Make an exposure and check the mAs with the mAs meter.

Note

Error 12 is never displayed in Manual Calibration, regardless of the real mA value.

- If the measured mAs are correct, replace the A3640-XX Control board.
 - If the measured mAs are not correct, proceed with step 15.
15. Check that both mAs and mA are different from "0" as measured in the mAs meter and in the Exposure Scope, no matter if the value is not correct.
 - If the measured value of mAs and mA is not "0", calibrate the Filament Current data.
 - If the measured value of mAs and mA is "0", proceed with 16.
 16. Turn the Electrical Room Cabinet (Main Disconnect) and generator OFF. Wait three (3) minutes for the Main Storage Capacitors to discharge.
 17. Disconnect J18 from the A3640-XX Control board and J1 from the High Voltage Transformer and check continuity between:

J18.6 ↔ J1.M (-mA)
J18.3 ↔ J1.R (+mA)
 - If the connections are not correct, repair them.
 - If the connections are correct, proceed with step 18.

18. Turn the Room Electrical Cabinet (Mains Disconnect) and Generator ON.
19. Perform the Filament Current measurement test according to the table below. To do so:
 - a. Connect a DC voltmeter to the corresponding test point, according to the Focal Spot to be used for the test:
 - TP35 (FIL_FF) of the Control board for Small Focal Spot.
 - TP36 (FIL_FG) of the Control board for Large Focal Spot.
 - b. Go to the Manual Calibration screen of the Service Console, select the required Filament value and press "Prep" to read the value with the voltmeter.

Note 

The High Voltage cables can be swapped in order to short-circuit the output of the Filament Transformers of the High Voltage Transformer.



NEVER EXCEED THE HIGHEST CALIBRATED VALUE IN NORMAL CONDITIONS DURING THIS TEST. OTHERWISE, PERMANENT DAMAGE CAN BE CAUSED TO THE TUBE.

Filament Current data	TP35 & TP36 on the Control board
Stand-by	1.25 V ^{DC}
1000	1.16 V ^{DC}
1250	1.45 V ^{DC}
1500	1.74 V ^{DC}
1750	2.00 V ^{DC}
2000	2.33 V ^{DC}
2250	2.62 V ^{DC}
2500	2.90 V ^{DC}
2750	3.20 V ^{DC}

- If the test results are correct, there might be a problem in the Tube's filament. Check and replace the Tube, if necessary.
- If the test results are not correct, proceed with step 20.

20. Perform the Primary voltage of the Filament Transformer measurement test according to the table below. To do so:
 - a. Measure with a True RMS AC voltmeter between the corresponding pins, according to the Focal Spot to be used for the test:
 - J13.1 and J13.3 for Large Focal Spot.
 - J13.3 and J13.5 for Small Focal Spot.
 - b. Go to the Manual Calibration screen of the Service Console, select the required Filament value and press "Prep" to read the value with the voltmeter.

Note 

The High Voltage cables can be swapped in order to short-circuit the output of the Filament Transformers of the High Voltage Transformer.



NEVER EXCEED THE HIGHEST CALIBRATED VALUE IN NORMAL CONDITIONS DURING THIS TEST. OTHERWISE, PERMANENT DAMAGE CAN BE CAUSED TO THE TUBE.

Filament Current data	J13.1 & J13.3 / J13.3 & J13.5 on the Control board
Stand-by	126 V~
1000	123 V~
1250	134 V~
1500	145 V~
1750	155 V~
2000	164 V~
2250	173 V~
2500	181 V~
2750	190 V~

- If the test results are correct, there might be a problem in the High Voltage Transformer. Check and replace it, if necessary.
- If the test results are not correct, replace the A3640-XX Control board.

ERROR CODE: E013 kVp RANGE ERROR

DESCRIPTION :	Anode-Cathode voltage is out of range during exposure.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During exposure.

POSSIBLE CAUSES

The A3640-XX Control board is defective.
The DC-BUS goes down during exposure.
Fault/noise in the kVp measure.
Incorrect kVp gain calibration.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, open the Exposure Scope of the Service Console and make an exposure to check the kVp value (*refer to the Calibration document*).
 - If the kVp value is out of the $\pm 15\%$ range, check calibration of the kVp gain.
 - If the measured value of kVp is correct, replace the A3640-XX Control board.

ERROR CODE: E014 kVp RAMP ERROR

DESCRIPTION :	Anode-Cathode voltage does not reach the final value in the designated rise time.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During exposure.

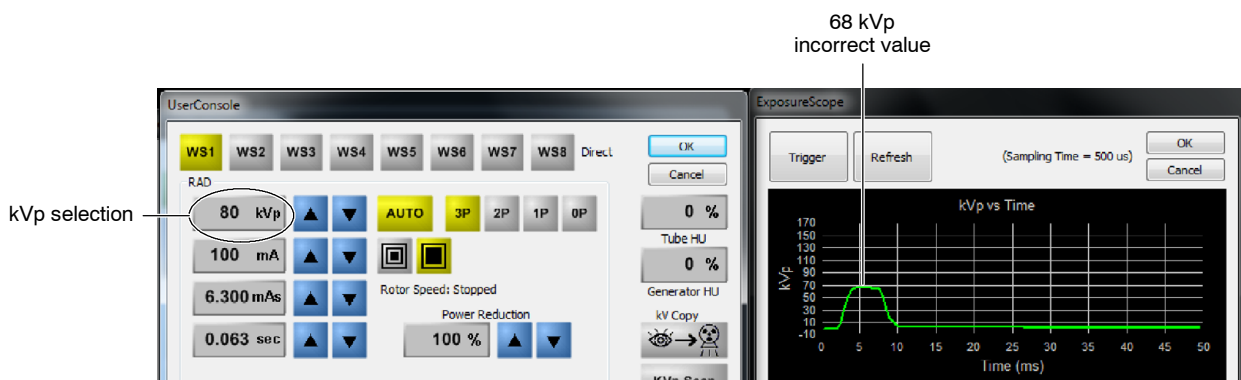
POSSIBLE CAUSES

- The A3640-XX Control board is defective.
- The DC-BUS goes down during exposure.
- Fault/noise in the kVp measure.
- kVp gain is not properly adjusted.
- Wrong connection on the A3063-XX IPM Driver board.
- The A3063-XX IPM Driver board is defective.
- Faulty IGBT.
- Open Serial Capacitor C9 in Power Inverter Module.
- Lack of +24V DELAY on the A3063-XX IPM Driver board.

ACTIONS

- Open the Exposure Scope of the Service Console (*refer to the Calibration document*). Select a parameters combination which causes Error 14 and make an exposure to check the kVp signal.
 - If there is no kVp signal, proceed with step 2.
 - If there is kVp signal, check if it is within the $\pm 15\%$ range (*refer to Illustration 4-6*).
 - If the kVp value is correct, replace the A3640-XX Control board.
 - If the kVp value is not correct, calibrate the kVp gain.

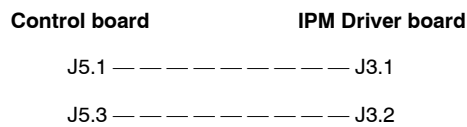
Illustration 4-6
kVp signal checking



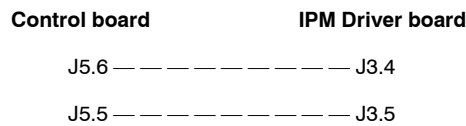


The following procedures involve the IPM Driver board, which is connected to the IGBTs. This area has dangerous HIGH VOLTAGE and must be treated with great care.

2. Check for +24V_DELAYED (LED DS2) between J3.1 and J3.2 of the A3063-XX IPM Driver board.
 - If the measurement is correct, proceed with step 3.
 - If the measurement is not correct, check for +24V_DELAYED between J5.1 and J5.3 of the A3640-XX Control board.
 - If the measurement is not correct, replace the A3640-XX Control board.
 - If the measurement is correct, check and repair the following connections:

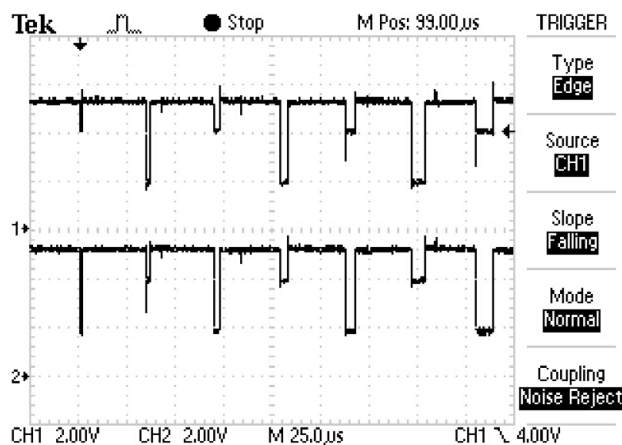


3. Make these connections with the Oscilloscope (the Exposure Scope cannot be used for this test):
 - CH.1 on TP2 of the IPM Driver board.
 - CH.2 on TP3 of the IPM Driver board.
4. Check if there are any pulses during the exposure (refer to Illustration 4-7).
 - If there are pulses during the exposure, proceed with step 5.
 - If there are no pulses during the exposure, check the following connections:



- If the connections are not correct, repair them.
- If the connections are correct, replace the A3640-XX Control board.

Illustration 4-7
Pulses checking on the Oscilloscope



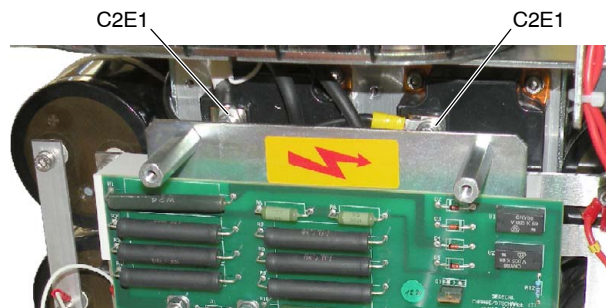
5. Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF.
6. Wait for the DC Bus of the Inverter to be fully discharged. When it is fully discharged the LEDs on the Charge/Discharge board will be completely turned off.



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 ARE OFF BEFORE SERVICING THE EQUIPMENT (APPROX. 3 MINUTES AFTER THE UNIT IS TURNED OFF).

7. When LEDs are off, connect a Multimeter between both C2E1 points of the IGBTs.

Illustration 4-8
C2E1 position



- a. In Capacitor mode the reading should be "O.L.μF" (OUT OF LIMIT).
- b. In "OHMS" mode there should be a resistance changing until a stable value of $\approx 1M\Omega$.
 - If the reading is not correct, proceed with step 8.
 - If the reading is correct, proceed with step 10.
8. Check that the resistance at P1 and P2 of the High Voltage Transformer is low (approximately $0.2\ \Omega$).
 - If the resistance is too high, replace the HV Transformer.
 - If the resistance is correct, proceed with step 9.
9. Check the following connections (*refer to schematic 543022XX for the connections between the HV Transformer and the IGBTs*):

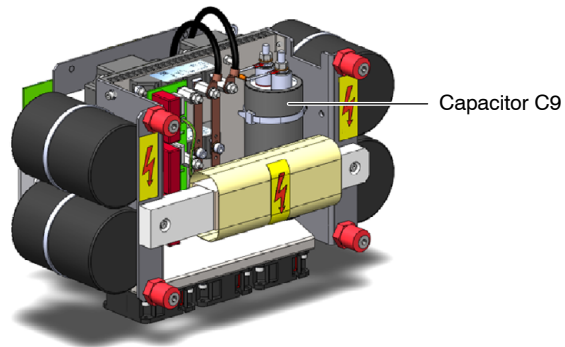
C2E1 (left side IGBT) — — — P3 (HVT)

C2E1 (right side IGBT) — — — C9

C9 — — — — — — — — — — P1 (HVT)

- If the connections are not correct, repair them.
- If the connections are correct, replace Capacitor C9 (refer to Illustration 4-9).

Illustration 4-9
Capacitor C9



10. The A3063-XX IPM Driver board or the IGBTs might be defective. It is recommended to replace the IPM Driver board first and if the problem persists, replace the defective IGBT(s) then.

Note 

It is not necessary to replace both IGBTs in case only one of them is defective.

11. To check the IGBTs, proceed as explained in steps 3. to 6. of Procedure B, "Inverter Module Test" of E009 Inverter Error (IGBT Fault).
12. If the measurement is different from the correct value, replace the IGBT.

ERROR CODE: E015 LARGE FIL CURRENT RANGE ERROR

DESCRIPTION :	Large filament current out of range.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	In stand-by or when pressing “Prep”.

POSSIBLE CAUSES

- Fault in the tube filament current control hardware (A3640-XX Control board).
- The tube large filament has blown up.
- The tube filament is not connected or there is a poor connection at the Cathode.
- Defective Filament Transformer inside the HV Transformer.
- Fault in the A3646-XX Supply board.
- Lack of voltage +SUPPLY/-SUPPLY in the A3640-XX Control board.

ACTIONS

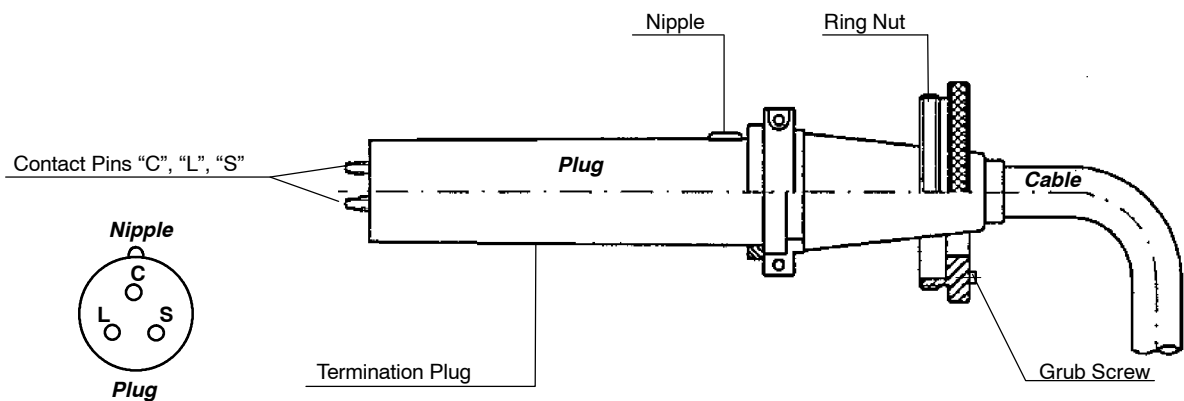
1. First of all, check the filament pre-heating value, as abnormally low values may cause this error. If the error appears **during stand-by, perform only step 2**. If error appears **when pressing “Prep”, perform steps 2. and 3.**
2. Open the Service Console and go to the Parameters Calibration screen to check the “Tube 1 - Large Focus Standby (#)” value. It should be within “718” and “1436”.
 - If the “Tube 1 - Large Focus Standby (#)” value is correct **and the error appears when pressing “Prep”, proceed with step 3**. If the value is correct **and the error appears during stand-by, proceed with step 4.**
 - If the “Tube 1 - Large Focus Standby (#)” value is not correct, press reset to restore the error code and perform the automatic calibration of the Large Focal Spot. If the error appears during the autocalibration procedure, press reset to restore and continue with the calibration.
 - Once the autocalibration is completed, go back to the Parameters Calibration screen to check the “Tube 1 - Large Focus Standby (#)” value again.
 - If the error continues to appear, proceed with step 4.
3. Go to the Manual Calibration screen and check the Filament Current data of the mA stations that cause the error.
 - If the Filament Current data are correct, proceed with step 4.
 - If any of the Filament Current data is lower than “1000”, calibrate it.
 - If the error continues to appear, proceed with step 4.

4. Perform the X-ray Tube Filaments resistance test:

With the Generator turned OFF, measure the Filaments of the Tube by disconnecting the Cathode High Voltage Cable from the HV Transformer (Generator side)

There are three pins located at the male end of the Plug: "C" (Common), "L" (Large) and "S" (Small). With an Ohm meter, measure between "C" and "S". If the filaments are OK (not opened), the reading should be close to zero Ohms. Also measure between "C" and "L" and between "L" and "S".

If there is an open circuit in any of the Tube filaments, measure the resistance on the Tube side. Remove the Cable from the Tube and test the ohms in the female plug (Tube side) with an Ohm meter that has sufficiently long probes.



5. Then, measure the Secondary of the Filament Transformer:

Measure with an Ohm Meter the pins inside the HV Transformer receptacle. For this, use long probes to be able to access to the pins of the "Female" High Voltage Connector of the HV Transformer. Measure between Common (this is the pin in line with the "Nipple") and Small (it is the pin to the left). Measure also between Common and Large (it is the pin to the right). The resistance should be around 0.5 Ohms for each Filament.

6. Once the test is finished, reconnect the Cathode HV cable in its position of the HV Transformer (it is marked in the Cable and in the HV Transformer). Clean the cable with a piece of clean dry paper before placing it inside the HV Transformer. Make sure you tighten the big washer of the HV Cable into the HV Transformer.

7. Turn ON the Generator and check if the error message still appears.

8. If the error is still present, check the voltage supply in the A3640-XX Control board. To do so, check that connector J1 is correctly plugged and measure with a voltmeter between J1.1 and J1.4. The measurement value should be $324\text{ V}^{\text{---}} \pm 10\%$.

- If the measured voltage is correct, proceed with step 9.
- If the measured voltage is not correct, check that connector J11 of the A3646-XX Supply board is correctly plugged and measure with a voltmeter between J11.1 and J11.4. The measurement value should be $324\text{ V}^{\text{---}} \pm 10\%$.

- If the measured voltage is correct, check and repair the following connections:

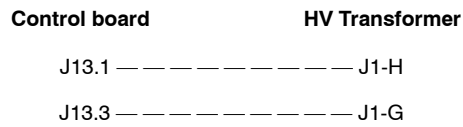
Supply board	Control board	
J11.1	J1.1	(+SUPPLY)
J11.4	J1.4	(-SUPPLY)

- If the measured voltage is not correct, replace the A3646-XX Supply board.

9. Measure the Primary of the Filament Transformer:

Turn the Generator OFF, disconnect J13 of the A3640-XX Control board and measure with an Ohm Meter in the cable connector between J13.1 and J13.3. The resistance should be around 3.8 Ohms for Transformers up to Rev. D and around 1.4 Ohms for Transformers from Rev. E.

- If the measurement is correct, replace the A3640-XX Control board.
- If the measurement is not correct, repeat it keeping the Generator turned off, this time by removing connector J1 on the HV Transformer and measuring on the Connector of the HV Transformer between the pin marked G (FIL_CURR_RTN) and H (FIL_SUPP_FG).
 - If the measurement is not correct, replace the HV Transformer.
 - If the measurement is correct, reconnect J1 to the HV Transformer and ensure that is securely connected and "locked" into position by twisting the outside cover until a "click" is heard. Then, check and repair the following connections:



ERROR CODE: E016 SMALL FIL CURRENT RANGE ERROR

DESCRIPTION :	Small filament current out of range.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	In stand-by or when pressing "Prep".

POSSIBLE CAUSES

Fault in the tube filament current control hardware (A3640-XX Control board).
The tube small filament has blown up.
The tube filament is not connected or there is a poor connection at the Cathode.
Defective Filament Transformer inside the HV Transformer.
Fault in the A3646-XX Supply board.
Lack of voltage +SUPPLY/-SUPPLY in the A3640-XX Control board.

ACTIONS

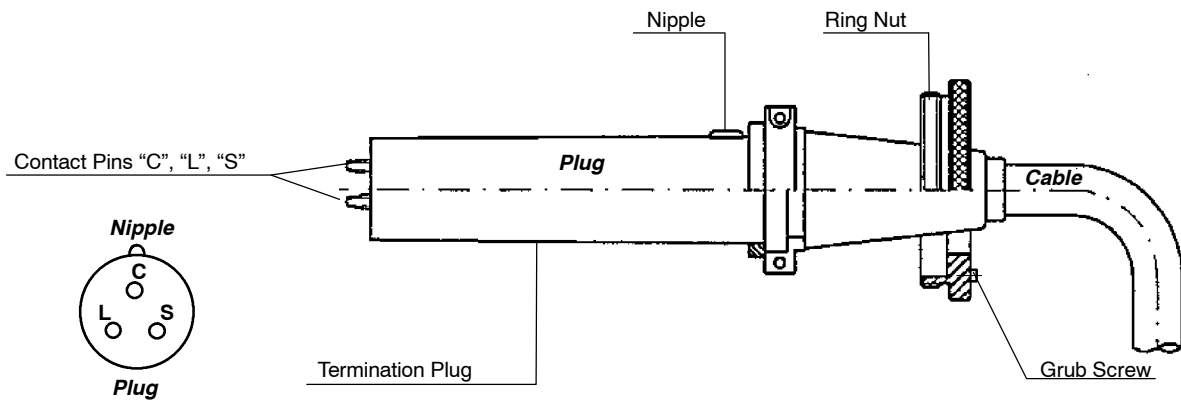
1. First of all, check the filament pre-heating value, as abnormally low values may cause this error. If the error appears **during stand-by, perform only step 2**. If error appears **when pressing "Prep", perform steps 2. and 3.**
2. Open the Service Console and go to the Parameters Calibration screen to check the "Tube 1 - Small Focus Standby (#)" value. It should be within "718" and "1436".
 - If the "Tube 1 - Small Focus Standby (#)" value is correct **and the error appears when pressing "Prep"**, proceed with **step 3**. If the value is correct **and the error appears during stand-by**, proceed with **step 4**.
 - If the "Tube 1 - Small Focus Standby (#)" value is not correct, press reset to restore the error code and perform the automatic calibration of the Small Focal Spot. If the error appears during the autocalibration procedure, press reset to restore and continue with the calibration.
 - Once the autocalibration is completed, go back to the Parameters Calibration screen to check the "Tube 1 - Small Focus Standby (#)" value again.
 - If the error continues to appear, proceed with step 4.
3. Go to the Manual Calibration screen and check the Filament Current data of the mA stations that cause the error.
 - If the Filament Current data are correct, proceed with step 4.
 - If any of the Filament Current data is lower than "1000", calibrate it.
 - If the error continues to appear, proceed with step 4.

4. Perform the X-ray Tube Filaments resistance test:

With the Generator turned OFF, measure the Filaments of the Tube by disconnecting the Cathode High Voltage Cable from the HV Transformer (Generator side)

There are three pins located at the male end of the Plug: "C" (Common), "L" (Large) and "S" (Small). With an Ohm meter, measure between "C" and "S". If the filaments are OK (not opened), the reading should be close to zero Ohms. Also measure between "C" and "L" and between "L" and "S".

If there is an open circuit in any of the Tube filaments, measure the resistance on the Tube side. Remove the Cable from the Tube and test the ohms in the female plug (Tube side) with an Ohm meter that has sufficiently long probes.



5. Then, measure the Secondary of the Filament Transformer:

Measure with an Ohm Meter the pins inside the HV Transformer receptacle. For this, use long probes to be able to access to the pins of the "Female" High Voltage Connector of the HV Transformer. Measure between Common (this is the pin in line with the "Nipple") and Small (it is the pin to the left). Measure also between Common and Large (it is the pin to the right). The resistance should be around 0.5 Ohms for each Filament.

6. Once the test is finished, reconnect the Cathode HV cable in its position of the HV Transformer (it is marked in the Cable and in the HV Transformer). Clean the cable with a piece of clean dry paper before placing it inside the HV Transformer. Make sure you tighten the big washer of the HV Cable into the HV Transformer.
7. Turn ON the Generator and check if the error message still appears.
8. If the error is still present, check the voltage supply in the A3640-XX Control board. To do so, check that connector J1 is correctly plugged and measure with a voltmeter between J1.1 and J1.4. The measurement value should be $324 \text{ V}^{\text{---}} \pm 10\%$.
 - If the measured voltage is correct, proceed with step 9.
 - If the measured voltage is not correct, check that connector J11 of the A3646-XX Supply board is correctly plugged and measure with a voltmeter between J11.1 and J11.4. The measurement value should be $324 \text{ V}^{\text{---}} \pm 10\%$.

- If the measured voltage is correct, check and repair the following connections:

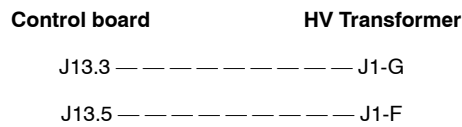
Supply board	Control board	
J11.1	— — — — — J1.1	(+SUPPLY)
J11.4	— — — — — J1.4	(-SUPPLY)

- If the measured voltage is not correct, replace the A3646-XX Supply board.

9. Measure the Primary of the Filament Transformer:

Turn the Generator OFF, disconnect J13 of the A3640-XX Control board and measure with an Ohm Meter in the cable connector between J13.3 and J13.5. The resistance should be around 3.8 Ohms for Transformers up to Rev. D and around 1.4 Ohms for Transformers from Rev. E onwards.

- If the measurement is correct, replace the A3640-XX Control board.
- If the measurement is not correct, repeat the test keeping the Generator turned off, this time by removing connector J1 on the HV Transformer and measuring on the Connector of the HV Transformer between the pin marked G (FIL_CURR_RTN) and F (FIL_SUPP_FF).
 - If the measurement is not correct, replace the HV Transformer.
 - If the measurement is correct, reconnect J1 to the HV Transformer and ensure that is securely connected and "locked" into position by twisting the outside cover until a "click" is heard. Then, check and repair the following connections:



ERROR CODE: E018 ROTOR ERROR

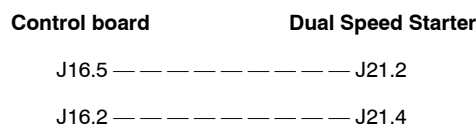
DESCRIPTION :	The Anode Rotor Controller (starter) is not sending back the Ready condition within the designated time.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing “Prep”/Fluoro pedal.
INFORMATION/SYMPTOM :	Exposure is not allowed.

POSSIBLE CAUSES

- Defective Dual Speed Starter.
- Previous detection of an Anode Rotor Controller related error that inhibits its further operation.
- Lack of +5V in the S0008009 Dual Speed Starter.
- Defective connection between the A3640-XX Control board and the S0008009 Dual Speed Starter.
- Defective A3646-XX Supply board.

ACTIONS

- Press reset to restore the error code and check again.
- If the error persists, reboot the Generator and check if there is any other error present during the startup sequence.
 - If there is another error during the startup sequence, follow the corresponding procedure described in this section.
 - If no other error is detected, proceed with step 3.
- Check the voltage on TP42 (+5.15V ± 100mV) of the S0008009 Dual Speed Starter.
 - If the voltage is correct, check that the ribbon cable between J19 of the S0008009 Dual Speed Starter and J7 of the A3640-XX Control board is in proper conditions and correctly connected at both ends.
 - Replace the cable, if necessary.
 - If the cable is not defective and properly connected, replace the S0008009 Dual Speed Starter.
 - If the voltage is out of boundaries, adjust the Power Supply potentiometer (*refer to Section 2.3*).
 - If there is no voltage present in TP42, check for +5.15V ± 100mV on J16.5 and J16.2 of the A3646-XX Supply board.
 - If there is no voltage, replace the A3646-XX Supply board.
 - If the voltage is present, check/repair the following connections:



ERROR CODE: E019 mA WITHOUT EXP ERROR

DESCRIPTION :	Tube current without exposure order from the microcontroller.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	In stand-by with the Filaments enabled.

POSSIBLE CAUSES

- Defective A3640-XX Control board.
- Defective wiring.
- Incorrect Stator cable connection.

ACTIONS**Note** 

Before servicing the equipment, make sure that the Filaments are enabled. In order to do so, check that the switch 3640SW6-4 of the Control board is set to OFF and that Filaments are not disabled by software in the Service Console.

1. Turn OFF the equipment and disconnect the J5 and J18 connectors from the A3640-XX Control board.
2. Turn ON the Generator.
 - If Error 19 persists, replace the A3640-XX Control board.
 - If Error 19 disappears, proceed with step 3.
3. Turn OFF the Generator and check if any wire of the Stator cable is connected to TS1-10 (-MA.DRT). If so, disconnect it, reconnect J5 and J18 in the A3640-XX Control board and turn ON the Generator.
 - If Error 19 disappears, make sure that it is absolutely necessary to connect the Stator cable to TS1-10.

Note 

Remember that only X-ray Tubes with a Metallic Insert Envelope have to be connected to Terminal BLock TS1-10.

- If Error 19 persists, proceed with step 4.
4. Turn OFF the Generator and disconnect the J5 connector from the A3640-XX Control.
5. Turn ON the Generator.
 - If Error 19 disappears, replace the A3640-XX Control board.
 - If Error 19 persists, check for possible short-circuits in the wiring that might be generating voltage in J18.3 or in J18.6 of the A3640-XX Control board. In stand-by mode, the voltage in those connectors must be 0 V^{DC} in respect to J18.7.

ERROR CODE: E020 kVp WITHOUT EXP ERROR

DESCRIPTION :	Anode-Cathode voltage without exposure order from the microcontroller.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	In stand-by.

POSSIBLE CAUSES

- Defective A3640-XX Control board.
- Defective wiring.

ACTIONS

1. Turn OFF the equipment and disconnect the J5 and J18 connectors from the A3640-XX Control board.
2. Turn ON the Generator.
 - If Error 20 persists, replace the A3640-XX Control board.
 - If Error 20 disappears, proceed with step 3.
3. Turn OFF the Generator and reconnect only J18.
4. Turn ON the Generator.
 - If Error 20 disappears, replace the A3640-XX Control board.
 - If Error 20 persists, check for possible short-circuits in the wiring that might be generating voltage in J18.1 or in J18.2 of the A3640-XX Control board. In stand-by mode, the voltage in those connectors must be 0 V⁻⁻⁻ in respect to J18.7.

ERROR CODE: E023 EEPROM ERROR

DESCRIPTION :	Error while writing in the EEPROM.
ERROR TYPE :	"Unrecoverable", the system remains lock.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	After making an X-ray exposure or after saving calibration or configuration data.

POSSIBLE CAUSES

The EEPROM is defective.
Defective Control board.

ACTIONS

1. Check that the U66 EEPROM is correctly installed in the socket:
 - If the EEPROM is plugged upside down, place it correctly.
 - If the EEPROM is correctly installed, make a backup copy (*refer to the General backup section of the Configuration document*) and initialize it.

Note 

If the EEPROM is initialized, the calibration data will be lost and the system configuration will be overwritten with the default values.

2. If the error persists, follow the procedure described for E001 (Backup timer — I2C error), steps 2. and 3.
3. If the error persists and there is an available EEPROM to be used as a test tool, turn OFF the generator and replace the EEPROM with the second one.



Make sure to make a backup copy of the information contained in the EEPROM to be used.

4. Turn ON the Generator and modify the configuration values to check if it is possible to write the EEPROM (*refer to the Configuration document*):
 - If it is possible to write the EEPROM, keep it installed in the board and discard the old one.
 - If it is not possible to write the EEPROM, replace the A3640-XX Control board.

ERROR CODE: E024 BUCKY/DIGITAL PANEL ERROR

DESCRIPTION :	The designated time has elapsed since the exposure signal was activated while the equipment was "Ready" without any acknowledge from the WorkStation configured as Bucky or Digital Panel.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

Defective interconnection cable or hardware related to the signals RX_RQ (Request) or RX_ORDER (Acknowledge).

Bucky/Digital Panel is not sending the RX_ORDER signal.

ACTIONS

1. Check the wiring.
2. If the error persists, replace the defective hardware.

ERROR CODE: E025 LARGE FIL DEMAND ERROR

DESCRIPTION :	Large filament current demand above the limit.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing "Prep" or during exposure.

POSSIBLE CAUSES

The filament current demand is not calibrated properly.
X-ray Tube is defective.
Defective Control board.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check the mA calibration data (*refer to the Calibration document*).
 - If the Filament Data shows an unreliable calibration, calibrate the mA station again or perform the whole calibration procedure, if needed (*refer to the Calibration document*).
 - If the Filament Data is correct, proceed with step 3.
3. Check the connection of the Anode and Cathode cables from the HV Transformer to the X-ray Tube, making sure they are connected to the corresponding receptacles.
 - If the HV cables are not properly connected, connect the cables correctly, maintaining correct Anode and Cathode orientation.
 - If the HV cables are correctly connected and the error persists, proceed with step 4.
4. Remove the collimator and check the Tube Large filament. To do so, select Large filament in the Service Console, press "Prep" and look through the Tube's window to check if the whole filament gets heated.
 - If the filament is damaged, replace the X-ray tube.
 - If the filament is in proper condition, proceed with step 5.
5. Check the Large filament current in TP25 of the A3640-XX Control board.
 - If the measured current does not match the selected one in the Service Console, replace the A3640-XX Control board.
 - If the measured current is correct, replace the HV Transformer.

ERROR CODE: E026 SMALL FIL DEMAND ERROR

DESCRIPTION :	Small filament current demand above the limit.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing “Prep” or during exposure.

POSSIBLE CAUSES

- The filament current demand is not calibrated properly.
- X-ray Tube is defective.
- Defective Control board.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check the mA calibration data (*refer to the Calibration document*).
 - If the Filament Data shows an unreliable calibration, calibrate the mA station again or perform the whole calibration procedure, if needed (*refer to the Calibration document*).
 - If the Filament Data is correct, proceed with step 3.
3. Check the connection of the Anode and Cathode cables from the HV Transformer to the X-ray Tube, making sure they are connected to the corresponding receptacles.
 - If the HV cables are not properly connected, connect the cables correctly, maintaining correct Anode and Cathode orientation.
 - If the HV cables are correctly connected and the error persists, proceed with step 4.
4. Remove the collimator and check the Tube Small filament. To do so, select Small filament in the Service Console, press “Prep” and look through the Tube’s window to check if the whole filament gets heated.
 - If the filament is damaged, replace the X-ray tube.
 - If the filament is in proper condition, proceed with step 5.
5. Check the Small filament current in TP26 of the A3640-XX Control board.
 - If the measured current does not match the selected one in the Service Console, replace the A3640-XX Control board.
 - If the measured current is correct, replace the HV Transformer.

ERROR CODE: E027 kVp POTENTIOMETER — I2C ERROR

DESCRIPTION : I2C Bus error while trying to access the digital potentiometer that adjusts the kV oscillator.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.
APPEARS WHEN : During the startup sequence.

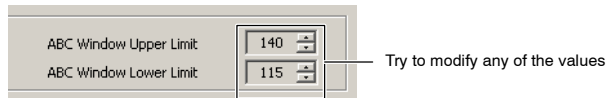
POSSIBLE CAUSES

It is not possible to communicate with the digital potentiometer.

ACTIONS

1. Press reset to restore the error code and check again.
2. Follow the procedure described for E001 (Backup timer — I2C error).
3. If no problem is found, try to modify the value of the ABC potentiometer in the Parameters Calibration screen of the Service Console (refer to the Calibration document).

Illustration 4-10
ABC calibration menu



4. If the value of the potentiometer cannot be modified, replace the A3640-XX Control board.

ERROR CODE: E028 ABC POTENTIOMETER — I2C ERROR

DESCRIPTION :	I2C Bus error while trying to access the digital potentiometers that adjust the ABC window.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.

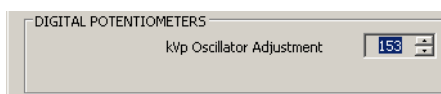
POSSIBLE CAUSES

It is not possible to communicate with the digital potentiometers.

ACTIONS

1. Press reset to restore the error code and check again.
2. Follow the procedure described for E001 (Backup timer — I2C error).
3. If no problem is found, try to modify the value of the the kVp potentiometer in the Parameters Calibration screen of the Service Console (refer to the kVp oscillator adjustment in the Calibration document).

Illustration 4-11
kVp Oscillator Adjustment



4. If the value of the potentiometer cannot be modified, replace the A3640-XX Control board.

ERROR CODE: E029 GENERATOR OVERHEAT ERROR

DESCRIPTION :	Generator heat capacity exceeded. “Warning”.
ERROR TYPE :	Informative. Recovers when the condition no longer exists.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	After an X-ray exposure.

POSSIBLE CAUSES

The generator temperature is too high so the selected exposure is inhibited.

ACTIONS

1. Wait until the generator gets cooler or decrease the exposure parameters selection.

ERROR CODE: E030 CORRUPT RTC ERROR

DESCRIPTION :	Wrong date stored in the Real Time Clock (RTC) and/or in the time stamp.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.

POSSIBLE CAUSES

- The RTC has not been initialized.
- The RTC battery is flat or missed.
- The RTC is failing.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check the RTC configuration.
 - Modify the time and date of the generator if any of them or both are not correct (*refer to the Configuration document*).
 - If the RTC configuration is ok, Initialize the RTC.
3. If the error persists, open the Service Console and check if the Licence info is readable to ensure that the I2C Bus is working (*refer to the Configuration document*).
 - If the Licence is not readable, follow the procedure described for E001 (Backup timer — I2C error).
 - If the Licence is readable, proceed with step 4.



WAIT UNTIL THE LIGHT EMITTING DIODES ON THE CHARGE/DISCHARGE BOARD AND ON THE ROTOR CONTROLLER ARE OFF BEFORE REMOVING THE BATTERY. OTHERWISE, DAMAGE CAN BE CAUSED TO THE A3640-XX CONTROL BOARD.

4. Check the voltage in BAT1.
 - If the measured voltage is below 2.8V, replace the battery.
 - If the measured voltage is correct, replace the A3640-XX Control board.

ERROR CODE: E031 TIME STAMP CHECK ERROR

DESCRIPTION :	The time stamp checksum is wrong.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.

POSSIBLE CAUSES

- The RTC has not been initialized.
- The RTC battery is flat or missed.
- The RTC is failing.

ACTIONS

1. Follow the procedure described for E030 (Corrupt RTC error).

ERROR CODE: E032 RTC — I2C ERROR

DESCRIPTION :	I2C Bus error while trying to access the Real Time Clock (RTC).
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	Anytime.

POSSIBLE CAUSES

- It is not possible to communicate with the RTC.

ACTIONS

1. Follow the procedure described for E001 (Backup timer — I2C error).

ERROR CODE: E033 COMMUNICATIONS ERROR (Comms lost at the Console)

DESCRIPTION :	The remote console has lost communication with the generator.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

The status is not being received at the required rate.

ACTIONS

1. Check the wiring between the Generator and the remote console.

ERROR CODE: E034 TANK PRESOSTAT ERROR

DESCRIPTION :	Tank presostat opened.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing “Prep”.

POSSIBLE CAUSES

The tank presostat has been opened due to overheat or hardware fault.
Presostat is not connected but it is selected in the Configuration screen.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists and the equipment is not equipped with presostat, proceed with step 3. If the equipment is equipped with presostat, proceed with step 4.
3. Check that presostat is not selected in the Configuration screen (*refer to the Configuration document*).
 - a. In case it is selected, set this option to “No”.
 - b. If presostat is not selected and the error persists, proceed with step 5.
4. Wait until the tank gets cooler.
 - a. If the error persists, take into account that this error may appear when the HV Transformer surpasses its maximum internal pressure capacity and is close to deforming. In this case, the HV Transformer must be replaced.
 - b. If the HV Transformer has been replaced and the error persists, proceed with step 5.
5. Check the A3640-XX Control board.

ERROR CODE: E035 BUCKY MOTION (X-RAY ACK) ERROR

DESCRIPTION :	The acknowledge for X-rays from the Bucky or FPD has been lost before the end of the exposure.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The Bucky or FPD has removed the acknowledge for X-rays during the exposure.
- The Bucky or FPD (or its related circuitry) is failing.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, try to disable it by configuration. To do so, modify the “Bucky/FPD can abort EXP” configuration in the Service Console (*refer to the Configuration document for the available options*).
3. If the error persists, replace the defective hardware.

ERROR CODE: E036 TUBE THERMOSTAT ERROR

DESCRIPTION :	Tube thermostat opened. “Warning”.
ERROR TYPE :	Informative. Recovers when the condition no longer exists.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The housing thermostat has been opened due to overheat or hardware fault.

ACTIONS

1. Wait until the housing gets cooler
2. If the warning doesn't disappear itself check the hardware.

ERROR CODE: E037 TUBE OVERLOAD ERROR

DESCRIPTION :	Tube ratings exceeded or not enough Heat Units to perform the selected exposure. "Warning".
ERROR TYPE :	Informative. Recovers when the condition no longer exists.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

The selected exposure is not possible due to the tube thermal status.

ACTIONS

1. Wait until the tube cools down or decrease the exposure parameters.

ERROR CODE: E038 +5V POWER SUPPLY FAILURE

DESCRIPTION :	+5V power supply is out of range.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

Power source is not well adjusted.

ACTIONS

1. Adjust power source value (*refer to Section 2.3*).

ERROR CODE: E039 +15V POWER SUPPLY FAILURE

DESCRIPTION :	+15V power supply is out of range.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

Power source is not well adjusted.

ACTIONS

1. Adjust power source value (*refer to Section 2.3*).

ERROR CODE: E040 IMBALANCED kVp ERROR

DESCRIPTION : Imbalanced kVp, there is not the same voltage in Anode and Cathode branches.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Defective A3640-XX Control board.
Defective high voltage tank.
Fault/noise in the measuring hardware.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, go to the Manual Calibration screen in the Service Console and increase the Filament Data value to start getting some current (*refer to the Calibration document*).
3. Check kVp imbalance in TP42 (kV+) and TP51 (kV-) by making exposures from 50 kVp to 140 kVp with the same Exposure Time and check that all kVp waveforms are symmetric and the values are similar according the table below.

Select	TP42 & TP51 on the Control board
50 kVp	2.2 V
70 kVp	3.0 V
90 kVp	3.9 V
110 kVp	4.7 V
125 kVp	5.3 V
130 kVp	5.6 V
140 kVp	6.0 V

Note 

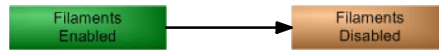
kV drop is slow due to the lack of charge.

- If the waveforms are symmetric (within 12% at any point), replace the A3640-XX Control board.
- If the waveforms are not symmetric (within 12% at any point), proceed with step 4. to perform the "Asymmetry on the kVp Loop" procedure.

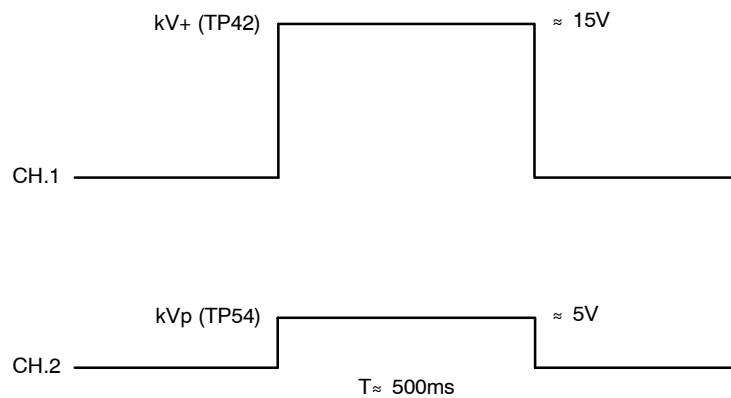
Note 

This procedure determines what part should be replaced due to asymmetry on the kVp Loop: the High Voltage Transformer or the A3640-XX Control board.

4. Set dip switch 3640SW6-4 on the A3640-XX Control board to **On** (disables Filaments) or press the Filaments button on the Service Console menu to disable the Filaments by software.

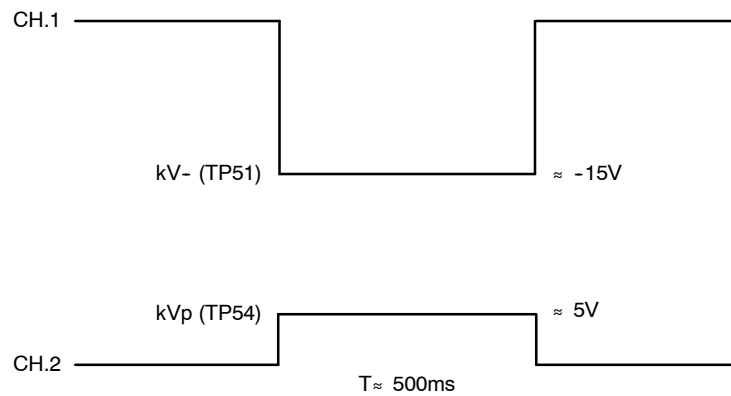


5. Make these connections with the Oscilloscope:
 - CH.1 on kV+ (TP42) on the Control board.
 - CH.2 on kVp (TP54) on the Control board.
6. Apply +15V (TP2 on the Control board) to kV+ (J18.2 on the Control board) for 500 ms. This operation may cause Error "020" if the voltage is applied for more than 500 ms. In this case, press reset to restore the error code.
7. Check the waveform's result:



- If it is OK, follow the procedure in step 8.
 - If it is not OK, replace the A3640-XX Control board.
8. Make these connections with the Oscilloscope:
 - CH.1 on kV- (TP51) on the Control board.
 - CH.2 on kVp (TP54) on the Control board.
 9. Apply -15V (TP1 on the Control board) to kV- (J18.1 on the Control board) for 500 ms. This operation may cause Error "020" if the voltage is applied for more than 500 ms. In this case, press reset to restore the error code.

10. Check the waveform's result:



- If it is OK, replace the HV Transformer.
 - If it is not OK, replace the A3640-XX Control board.
11. Set DIP switch 3640SW6-4 on the A3640-XX Control board to **Off** or press the Filaments button on the Service Console menu to enable the Filaments by software, depending on the action performed before on step 4.
12. Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

ERROR CODE: E041 IMBALANCED mA ERROR

DESCRIPTION : Imbalanced mA, there is not the same current in Anode and Cathode branches.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

- Defective A3640-XX Control board.
- Defective high voltage tank.
- Fault/noise in the measuring hardware.

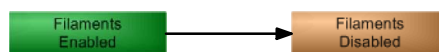
ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, go to the Manual Calibration screen in the Service Console and increase the Filament Data value to start getting some current (*refer to the Calibration document*).
3. Check mA imbalance in TP56 (mA+) and TP59 (mA-).
 - If the waveforms are symmetric (within 12% at any point), replace the A3640-XX Control board.
 - If the waveforms are not symmetric (within 12% at any point), proceed with step 4. to perform the "Asymmetry on the mA Loop" procedure.

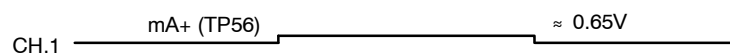
Note 

This procedure determines what part should be replaced due to asymmetry on the kVp Loop: the High Voltage Transformer or the A3640-XX Control board.

4. Set dip switch 3640SW6-4 on the A3640-XX Control board to **On** (disables Filaments) or press the Filaments button on the Service Console menu to disable the Filaments by software.

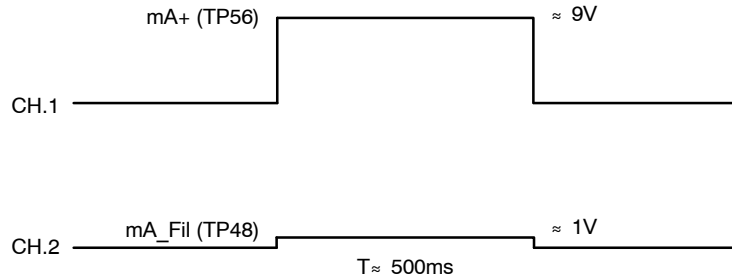


5. Make these connections with the Oscilloscope:
 - CH.1 on mA+ (TP56) on the Control board.
 - CH.2 on mA_Fil (TP48) on the Control board.
6. Apply +15V (TP2 on the Control board) to J18.3 on the Control board for 500 ms.
7. Check the waveform's result:

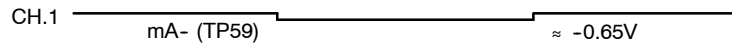


- If it is OK, follow the procedure in step 8.
- If it is not OK, replace the A3640-XX Control board.

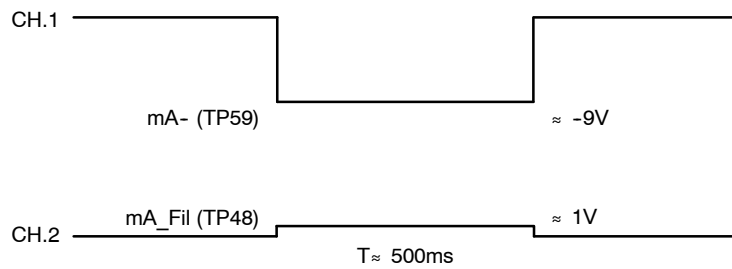
8. Apply +15V (TP2 on the Control board) to TP56 on the Control board for 500 ms.
9. Check the waveform's result:



- If it is OK, follow the procedure in step 10.
 - If it is not OK, replace the A3640-XX Control board.
10. Make these connections with the Oscilloscope:
 - CH.1 on mA- (TP59) on the Control board.
 - CH.2 on mA_Fil (TP48) on the Control board.
 11. Apply -15V (TP1 on the Control board) to J18.6 on the Control board for 500 ms.
 12. Check the waveform's result:



- If it is OK, follow the procedure in step 13.
 - If it is not OK, replace the A3640-XX Control board.
13. Apply -15V (TP1 on the Control board) to TP59 on the Control board for 500 ms.
 14. Check the waveform's result:



- If it is OK, replace the HV Transformer.
- If it is not OK, replace the A3640-XX Control board.

15. Set DIP switch 3640SW6-4 on the A3640-XX Control board to **Off** or press the Filaments button on the Service Console menu to enable the Filaments by software, depending on the action performed before on step 4.
16. Turn the Generator and Electrical Room Cabinet (Main Disconnect) OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.

ERROR CODE: E042 CORRUPT COUNTERS ERROR

DESCRIPTION :	The counters checksum is wrong.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The NVRAM has not been initialized.
 - The NVRAM is failing.
 - The power down capacitor is missed.
 - The power down capacitor is wrong.
-

ACTIONS

1. If the error persists, replace the defective hardware.

ERROR CODE: E043 CORRUPT ERROR LOG ERROR

DESCRIPTION :	The error log checksum is wrong.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The NVRAM has not been initialized.
 - The NVRAM is failing.
 - The power down capacitor is missed.
 - The power down capacitor is wrong.
-

ACTIONS

1. If the error persists, replace the defective hardware.

ERROR CODE: E044 EEPROM — I2C ERROR

DESCRIPTION :	I2C Bus error while trying to access the EEPROM.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

It is not possible to communicate with the EEPROM.

ACTIONS

1. Check the I2C Bus pull-up resistors (R225 and R226) and review all the elements connected to the I2C Bus: P89LPC925 (U60), M41T56 (U65), M24C16 (U66), AD5280 (U111), AD5282 (U112), licence and the related components to all of them.
2. Replace the defective element/s.

ERROR CODE: E045 CORRUPT TUBE DATA ERROR

DESCRIPTION :	The tube data checksum is wrong.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

The NVRAM has not been initialized.
No tube has been downloaded.
The power down capacitor is missed or wrong.
The NVRAM is failing.

ACTIONS

1. If the error persists, replace the defective hardware.

ERROR CODE: E046 BUSY BUS — I2C ERROR

DESCRIPTION : I2C bus error, the bus remains always busy.
ERROR TYPE : “Recoverable” with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

It is not possible to communicate as the bus is always busy.

ACTIONS

1. Review all the elements connected to the I2C Bus: P89LPC925 (U60), M41T56 (U65), M24C16 (U66), AD5280 (U111), AD5282 (U112), licence and the related components to all of them.
2. If the error persists, replace the defective element/s.

ERROR CODE: E047 LICENCE — I2C ERROR

DESCRIPTION : I2C bus error while trying to access the Licence.
ERROR TYPE : “Recoverable” with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

It is not possible to communicate with the Licence.

ACTIONS

1. Make sure the licence is installed and properly plugged in.
2. Check the I2C bus pull-up resistors (R225 and R226) and review all the elements connected to the I2C bus: P89LPC925 (U60), M41T56 (U65), M24C16 (U66), AD5280 (U111), AD5282 (U112), licence and the related components to all of them.
3. If the error persists, replace the defective element/s.

ERROR CODE: E048 DOOR ABORTED EXPOSURE

DESCRIPTION :	The door switch has been opened before the end of the exposure.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The door has been opened during the exposure.
- The door switch (or related circuitry) is failing.

ACTIONS

1. This error can be disabled by configuration (*refer to the Configuration document*).
2. If the error persists, replace the defective hardware.

ERROR CODE: E049 COMMUNICATIONS ERROR (Comms lost at the Generator)

DESCRIPTION :	The generator has lost the communications with the remote console. This check has to be enabled through the communications.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The status is not being received at the required rate.

ACTIONS

1. Check the wiring between the Generator and the remote console.

ERROR CODE: E050 ABORTED EXPOSURE ERROR

DESCRIPTION :	The user has released the exposure device/s before the end of the exposure (Prep and/or Exp).
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The user has prematurely released the exposure device.
 - The exposure device (handswitch...) is failing.
-

ACTIONS

1. If the error persists, replace the defective hardware.

ERROR CODE: E051 WRONG EXPOSURE TIME ERROR

DESCRIPTION :	The exposure time is above the maximum (very unlikely) or it is so short that it is not reachable according to the present configuration (rise time and kVp decay/high voltage capacity).
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The exposure time is shorter than the addition of 25% of the rise time plus the kVp tail from the selected kVp to 75% of that value.
-

ACTIONS

1. Increase the exposure time.

ERROR CODE: E053 FLUORO SYNC ERROR

DESCRIPTION :	The timeout for receiving the fluoro synchronism pulse has elapsed.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

The synchronism pulse is not being received.

ACTIONS

1. This timeout can be disabled by configuration (*refer to the Configuration document*).
2. Check the wiring between the generator and the system.

ERROR CODE: E054 DIGITAL SYNC ERROR

DESCRIPTION :	The timeout for receiving the Digital/DSI synchronism pulse has elapsed.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

The synchronism pulse is not being received.

ACTIONS

1. This timeout can be disabled by configuration (*refer to the Configuration document*).
2. Check the wiring between the generator and the system.

ERROR CODE: E055 NOT ENOUGH DOSE ERROR

DESCRIPTION : The backup timer has elapsed before the AEC or the System has ended the exposure.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Backup time is too short.
Defective AEC or System connection.

ACTIONS

1. Increase the backup time.
2. If the problem persists check the wiring between the generator and the AEC/System.

ERROR CODE: E056 NOT ENOUGH BACKUP TIME ERROR

DESCRIPTION : The backup timer has elapsed before the Tomograph ends the exposure.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Backup time is too short.
Defective tomography signals connection.

ACTIONS

1. Increase the backup time.
2. If the problem persists check the wiring between the generator and the Tomograph.

ERROR CODE: E057 DUAL ENERGY ERROR

DESCRIPTION : It is not possible to load the Dual Energy parameters for the next exposure.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Tube and/or Generator too hot for the selected Dual Energy set of parameters.

ACTIONS

1. Wait until the tube and/or the unit gets cooler or select a more suitable technique for the current thermal status.

ERROR CODE: E058 TUBE1 DATA ERROR

DESCRIPTION : The tube data pointed by the tube 1 index are not defined, a default tube has been selected.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

No tube data have been downloaded into the location pointed by the tube 1 index.

ACTIONS

1. Download the tube data or select the proper location using the tube 1 index.

ERROR CODE: E059 TUBE2 DATA ERROR

DESCRIPTION :	The tube data pointed by the tube 2 index are not defined, a default tube has been selected.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

No tube data have been downloaded into the location pointed by the tube 2 index.

ACTIONS

1. Download the tube data or select the proper location using the tube 2 index.

ERROR CODE: E060 AUTOCAL ERROR

DESCRIPTION :	The number of exposures to autocalibrate a mA station has run out.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

Tube instability.
Defective filament control hardware.
Fault/noise in the mA measurement.

ACTIONS

1. Reset the error and continue with the Autocalibration process.
2. If the error persists, replace the defective hardware.

ERROR CODE: E061 LICENCE ERROR

DESCRIPTION :	There has been an error while trying to access the Licence data. Default options have been selected.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The Licence has not been burned.
- The Licence is defective.

ACTIONS

1. Check the Licence info (*refer to the Configuration document*).
2. If the error persists, replace the Licence.

ERROR CODE: E062 AEC ERROR

DESCRIPTION :	AEC selection error.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The AEC level for the current selection exceeds the boundaries.

ACTIONS

1. Try selecting different parameters and/or recalibrating the AEC (*refer to the Calibration document*).

ERROR CODE: E063 ROTOR READY ERROR

DESCRIPTION :	The Ready from the starter has been lost before the end of the exposure.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During exposure.

POSSIBLE CAUSES

The starter has deactivated the Ready condition during the exposure.

ACTIONS

1. If the error persists, replace the defective hardware.

ERROR CODE: E064 TANK FEEDBACK ERROR

DESCRIPTION :	The Feedback connector from the tank is not plugged in.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing “Prep”.

POSSIBLE CAUSES

The A3640-XX Control board connector J18 is not properly plugged in.
The junction between pins 7 and 8 is missing.

ACTIONS

1. Make sure the connector J18 and its junction between pins 7 and 8 are in place.

ERROR CODE: E065 +24V DELAYED POWER SUPPLY FAILURE

DESCRIPTION : +24V delayed power is out of range.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Power source is not well adjusted.

ACTIONS

1. Adjust power source value (*refer to Section 2.3*).

ERROR CODE: E066 +24V (UNR) POWER SUPPLY FAILURE

DESCRIPTION : +24V (unregulated) power supply is out of range.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Voltage value incorrect from the T2 transformer.
Voltage value incorrect from the Supply board.

ACTIONS

1. Check T2 transformer integrity and the A3646-XX Supply board.

ERROR CODE: E067 -15V POWER SUPPLY FAILURE

DESCRIPTION : -15V power supply is out of range.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Power source is not well adjusted.

ACTIONS

1. Adjust power source value (*refer to Section 2.3*).

ERROR CODE: E068 +3.3V POWER SUPPLY FAILURE

DESCRIPTION : +3.3V power supply is out of range.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Voltage from 3V3 regulator is not correct.

ACTIONS

1. Check the integrity of the U128 voltage regulator of the A3640-XX Control board.

ERROR CODE: E069 +24 PERMANENT (UNR) POWER SUPPLY FAILURE

DESCRIPTION : +24 permanent (unregulated) power supply is out of range.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Voltage value incorrect from the T2 transformer.
Voltage value incorrect from the Supply board.

ACTIONS

1. Check T2 transformer integrity and the A3646-XX Supply board.

ERROR CODE: E070 AEC RAPID TERMINATION

DESCRIPTION :	Exposure was aborted because a lack of radiation received on the AEC.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During exposure.

POSSIBLE CAUSES

Voltage is less than expected at 30% of the backup time.

ACTIONS

1. Make sure the tube is pointing the selected device and the proper parameters have been selected.

ERROR CODE: E071 INTERLOCK ERROR

DESCRIPTION :	Exposure was aborted because an interlock configured to abort exposures has been deactivated during the exposure.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

The interlock has been deactivated.
Hardware fault.

ACTIONS

1. Activate the interlock; if the warning doesn't disappear itself check the hardware.
2. If the interlock is not being used, configure it properly.

ERROR CODE: E072 POSITIONER OK ERROR

DESCRIPTION :	Exposure was aborted because the signal Positioner OK (configured to be used as an interlock) has been deactivated during the exposure.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

The signal has been deactivated.
Hardware fault.

ACTIONS

1. Activate the signal Positioner OK.
 2. If the warning doesn't disappear itself check the hardware.
 3. If the signal is not being used, configure it properly by setting the Spare Input 1 functionality as “None” (*refer to the Configuration document*).
-

ERROR CODE: E073 XON FEEDBACK ERROR

DESCRIPTION :	Exposure was aborted because the signal XON Feedback has not been activated or has been deactivated during the exposure.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

Hardware fault.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check the hardware (XON is the “logic and” of three signals: X-ray signal from the handswitch or fluoro pedal, Backup Timer TOUT signal and Main Controller X-ray signal).
3. Replace the A3640-XX Control board if required.

ERROR CODE: E074 COP GENERATOR RESET ERROR

DESCRIPTION : The generator has been reset because of the COP module.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Software failure.

ACTIONS

1. Press reset to restore the error code and check again.

ERROR CODE: E075 CLK GENERATOR RESET ERROR

DESCRIPTION : The generator has been reset because of the CLK module.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Software failure.

ACTIONS

1. Press reset to restore the error code and check again.

ERROR CODE: E076 TRAP GENERATOR RESET ERROR

DESCRIPTION : The generator has been reset because of an illegal operation code.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Software failure.

ACTIONS

1. Press reset to restore the error code and check again.

ERROR CODE: E077 SOFTWARE INTERRUPT GENERATOR RESET ERROR

DESCRIPTION : The generator has been reset because of a software interrupt.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Software failure.

ACTIONS

1. Press reset to restore the error code and check again.

ERROR CODE: E078 MEMORY OVERFLOW INTERRUPT GENERATOR RESET ERROR

DESCRIPTION : The generator has been reset because of a memory overflow interrupt.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Software failure.

ACTIONS

1. Press reset to restore the error code and check again.

ERROR CODE: E079 REQUIRED MA STATIONS CAL ERROR

DESCRIPTION : The required mA stations have not been calibrated.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

At least one required mA station has not been properly calibrated and it has the default value.

ACTIONS

1. Recalibrate the generator or the required mA stations.

ERROR CODE: E091 HEARTBEAT ERROR (R2CP Protocol)

DESCRIPTION :	The main controller is not receiving the Heartbeat messages within the configured timeout. R2CP (CAN) protocol functionality.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

The host controller is not sending the Heartbeats with the proper pace
There could be a problem in the CAN cable.
There could be a problem in the CAN connections.

ACTIONS

1. Check the CAN cable.
2. Make sure the termination resistors are properly settled and the host controller is sending the messages properly.
3. If the problem persists, try increasing the configured Heartbeat pace.

ERROR CODE: E099 INCORRECT MESSAGE

DESCRIPTION :	Last message was not recognized as a SHFR protocol message.
ERROR TYPE :	This error applies to communications layer only and it is not presented to the user.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

Message is not as long as expected.
Message is not written correctly.
Communications are overloaded.
The command has been sent in the wrong mode or phase.

ACTIONS

1. Ensure messages are as long as expected, well written and messages are not overloading communications.

ERROR CODE: E101 NO SPEED AVAILABLE

DESCRIPTION :	The starter does not allow starting the tube neither in high speed nor in low speed.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing “Prep”.

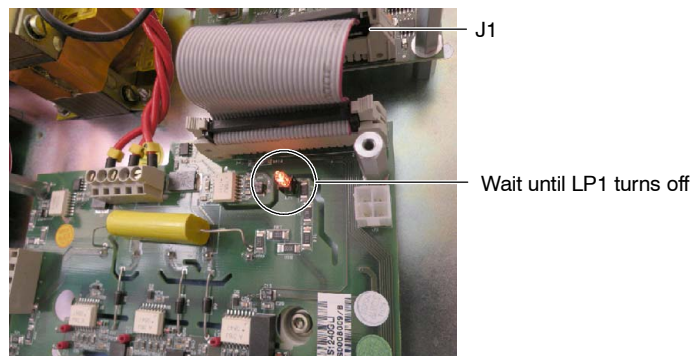
POSSIBLE CAUSES

The combination of tube selection, booster presence and generator configuration/licence does not allow starting the tube in high or low speed.

ACTIONS

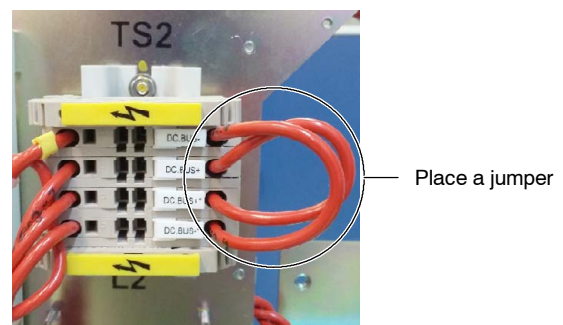
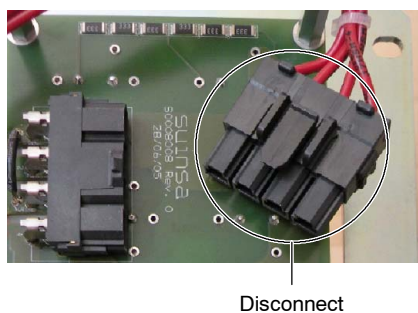
1. Press reset to restore the error code and check again.
2. If the error persists, disconnect the S0008007 Booster module (if equipped). In order to do so:
 - a. Turn OFF the equipment and wait for the LP1 light of the S0008009 Dual Speed Starter to completely turn off (*refer to Illustration 4-12*).
 - b. Then, disconnect the ribbon cable from J1 of the S0008007 Booster module.

Illustration 4-12
LP1 light



- c. Finally, disconnect J7 connector from the S0008007 Booster module and from TS2 and place a jumper in TS2 between pins 1-4 and 2-3 (*refer to Illustration 4-13*).

Illustration 4-13
J7 connector of the S0008007 Booster module and jumper in TS2



3. Review the configured Tube:
 - a. Check that the installed tube allows the selected speed. Otherwise, modify the exposure parameters to match the Tube specifications.
 - b. Check in the Licence Info that the configured Tube matches the allowed parameters by licence (*refer to the Configuration document*). Otherwise, replace the installed Tube with a new one or order a new licence with the needed options.
4. If the Tube configuration is correct and the error persists, reconnect the S0008007 Booster module (if equipped) and make sure it is properly connected and working.
5. Check the S0008009 Dual Speed Starter LEDs for any possible errors indication.
 - If there is any error indicated in the S0008009 Dual Speed Starter LEDs, follow the corresponding procedure described in this section.
 - If there is no other error indication, replace the S0008007 Booster module.

ERROR CODE: E102 LOW SPEED UNAVAILABLE

DESCRIPTION :	The starter does not allow starting the tube in low speed.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing “Prep”.

POSSIBLE CAUSES

The combination of tube selection, booster presence and generator configuration/licence does not allow starting the tube in low speed.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check that the installed tube allows the selected speed. If the tube only allows high speed operation, modify the exposure parameters to match the Tube specifications.
3. If the error persists and the tube only allows high speed operation, check in the Licence Info that high speed is allowed by licence (*refer to the Configuration document*). Otherwise, replace the installed Tube with a new one or order a new licence with the needed options.

ERROR CODE: E103 HIGH SPEED UNAVAILABLE

DESCRIPTION :	The starter does not allow starting the tube in high speed.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing “Prep”.

POSSIBLE CAUSES

The combination of tube selection, booster presence and generator configuration/licence does not allow starting the tube in high speed.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, open the Service Console and check in the Licence Info if High Speed is allowed (*refer to the Configuration document*).
3. If the installed Tube allows high speed operation without the S0008007 Booster module, follow the procedure described for E101 (No speed available), steps 2. to 5.

ERROR CODE: E104 DOSIMETER TUBE 1 NO ANSWER ERROR

DESCRIPTION : The dosimeter of the tube 1 doesn't respond.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Communication with the dosimeter is lost.
The dosimeter is unable to communicate.

ACTIONS

1. Check communication cable and connectors, power source and integrity of the dosimeter.

ERROR CODE: E105 DOSIMETER TUBE 1 TEST ERROR

DESCRIPTION : The dosimeter of the tube 1 didn't complete initialization test.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Incompatibility between versions of the dosimeter and the generator.
Wrong dosimeter.
Internal dosimeter problem.

ACTIONS

1. Review compatibility of the generator with dosimeter model and integrity of the dosimeter.

ERROR CODE: E106 DOSIMETER TUBE 1 STATUS ERROR

DESCRIPTION :	The dosimeter of the tube 1 answered a wrong or unexpected status.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- Dosimeter has an internal error.
 - Messages from the dosimeter are unexpected in the current system status.
-

ACTIONS

1. Reset the generator to force initial tests.

ERROR CODE: E107 DOSIMETER TUBE 2 NO ANSWER ERROR

DESCRIPTION :	The dosimeter of the tube 2 doesn't respond.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- Communication with the dosimeter is lost.
 - The dosimeter is unable to communicate.
-

ACTIONS

1. Check communication cable and connectors, power source and integrity of the dosimeter.

ERROR CODE: E108 DOSIMETER TUBE 2 TEST ERROR

DESCRIPTION : The dosimeter of the tube 2 didn't complete initialization test.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

Incompatibility between versions of the dosimeter and the generator.
Wrong dosimeter.
Internal dosimeter problem.

ACTIONS

1. Review compatibility of the generator with dosimeter model and integrity of the dosimeter.

ERROR CODE: E109 DOSIMETER TUBE 2 STATUS ERROR

DESCRIPTION : The dosimeter of the tube 2 answered a wrong or unexpected status.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.

POSSIBLE CAUSES

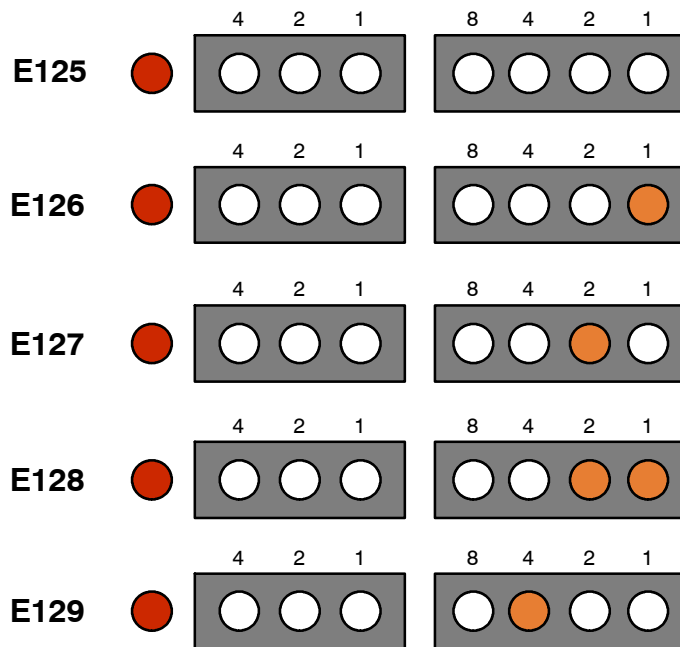
Dosimeter has an internal error.
Messages from the dosimeter are unexpected in the current system status.

ACTIONS

1. Reset the generator to force initial tests.

ERROR CODE:	E125 ROM TEST ERROR (LED CODE 00 HEX)
	E126 INSTRUCTIONS TEST ERROR (LED CODE 01 HEX)
	E127 INTERNAL RAM TEST (LED CODE 02 HEX)
	E128 EXTERNAL RAM TEST (LED CODE 03 HEX)
	E129 INITIALIZATION ERROR (LED CODE 04 HEX)

DESCRIPTION :	The starter microcontroller has detected an internal error.
ERROR TYPE :	“Unrecoverable”, the system remains lock.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.
INFORMATION/SYMPTOM :	Only displayed on the S0008009 Dual Speed Starter LEDs.



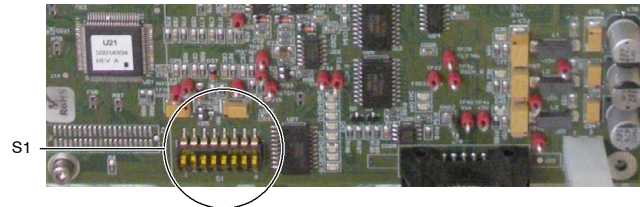
POSSIBLE CAUSES

Defective starter microcontroller.

ACTIONS

1. Check the S0008009 Dual Speed Starter D47, D48, D49 and D50 LEDs to identify the error.
2. Press reset to restore the error code and check again.

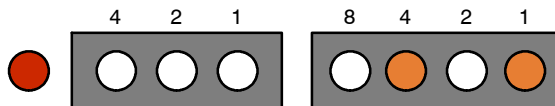
3. If the error persists, check that Dip switch S0008009S1 on the S0008009 Dual Speed Starter is in the right position. All switches but switch 2 must be set to OFF. Switch 2 must be in ON position.

Illustration 4-14**S0008009 Dual Speed Starter switches location**

4. If all the switches are in correct position and the error persists, proceed with step 5.
5. Check the voltage on TP41 ($+5.15V \pm 100mV$) of the S0008009 Dual Speed Starter (refer to *Illustration 4-15*).
 - If the voltage is OK, proceed with step 6.
 - If the voltage is not OK, proceed with step 12.
6. Check the reference voltage (VAREF, $+5.15V \pm 100mV$) between TP38 and GND on the S0008009 Dual Speed Starter.
 - If VAREF is correct, proceed with step 7.
 - If VAREF is out of margins, proceed with step 9.
7. Turn the Generator OFF and ON again.
8. If the error persists, replace the S0008009 Dual Speed Starter.
9. Check the voltage ($+14.9V \pm 800mV$) in the A3646-XX Supply board (refer to *Section 2.3*).
 - If the voltage is OK, proceed with step 10.
 - If the voltage is not OK, proceed with step 11.
10. Check the cable connected from J21 of the S0008009 Dual Speed Starter to J16 of the A3646-XX Supply board.
 - If the cable is OK, replace the S0008009 Dual Speed Starter.
 - If the cable is damaged, replace it.
11. Check the voltage ($+14.9V \pm 800mV$) in the Power Supply (refer to *Section 2.3*).
 - If the voltage is not OK, replace the Power Supply.
 - If the voltage is OK, proceed with step 14.
12. Check the voltage ($+5.15V \pm 100mV$) in the A3646-XX Supply board (refer to *Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage in the A3646-XX Supply board is correct, replace the S0008009 Dual Speed Starter.
 - If the voltage in the A3646-XX Supply board is not correct, proceed with step 13.
13. Check the voltage in the Power Supply.
 - If the voltage is not OK, replace the Power Supply.
 - If the voltage is OK, proceed with step 14.
14. Check the cable connected from J2 of the Power Supply to J14 of the A3646-XX Supply board.
 - If the cable is OK, replace the A3646-XX Supply board.
 - If the cable is defective, replace it.

ERROR CODE: E130 CAN WATCHDOG

DESCRIPTION :	The CAN bus error is activated.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	Anytime.
LED CODE :	05 HEX



POSSIBLE CAUSES

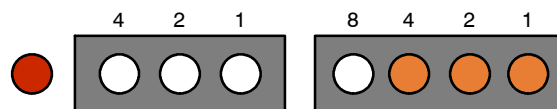
- CAN cable is defective.
- CAN cable is disconnected.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, verify that the CAN cable is properly connected to J19 of the S0008009 Dual Speed Starter.
3. If the CAN cable is properly connected, check the CAN wiring between J19 of the S0008009 Dual Speed Starter and J7 of the A3640-XX Control board:
 - If the cable is defective, replace it.
 - If the cable is in proper condition, proceed with step 4.
4. Check the voltage on TP41 (+5.15V \pm 100mV) of the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 5.
5. Check the voltage (+5.15V \pm 100mV) in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is not OK, proceed with step 6.
 - If the voltage is OK and the error persists, replace the S0008009 Dual Speed Starter.
6. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the power supply potentiometer to get +5.15V \pm 100mV (*refer to Section 2.3*).
 - If the voltage is OK, replace the A3646-XX Supply board.

ERROR CODE: E132 BOOSTER CURRENT TEST

DESCRIPTION : High speed module current test failure.
ERROR TYPE : "Unrecoverable", the system remains lock.
APPLICABLE TO : All Generators.
APPEARS WHEN : During the startup sequence. It can also appear when pressing "Prep" or during exposure.
LED CODE : 07 HEX



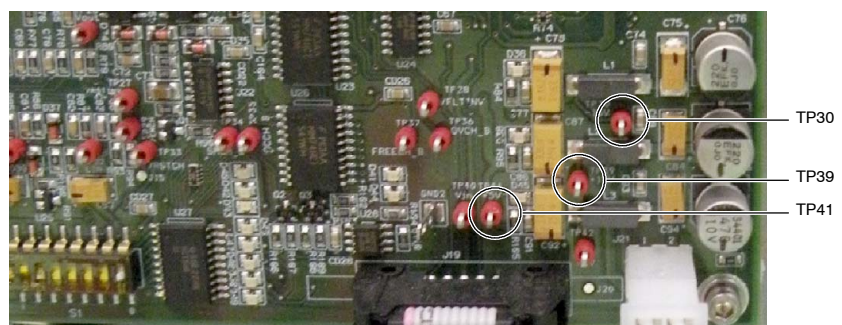
POSSIBLE CAUSES

No current detected by the Booster module during the initial test.

ACTIONS

1. Check the ribbon cable between J1 of the S0008007 Booster module and J5 of the S0008009 Dual Speed Starter.
 - If the ribbon cable is defective, replace it.
 - If the ribbon cable is OK, proceed with step 2.
2. Make sure that connectors J6, J7, J12 and J13 of the S0008007 Booster module are properly connected.
3. If connectors J6, J7, J12 and J13 are properly connected and the error persists, check L2 inductance by measuring the resistance between the cables connected to J12 and J13 (the resistance must be $\approx 0 \Omega$).
 - If L2 inductance is defective, replace it.
 - If L2 inductance is OK, proceed with step 4.
4. Check U12 sensor on the S0008007 Booster module.
 - If U12 sensor is defective, replace the S0008007 Booster module.
 - If U12 sensor is OK, proceed with step 5.
5. Check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (refer to Illustration 4-15).

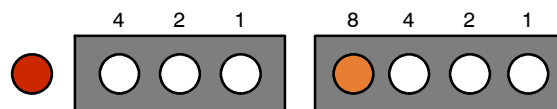
Illustration 4-15
+5V, +15V and -15V test points



- If the voltage is not OK, proceed with step 6.
 - If the voltage is OK, proceed with step 9.
6. Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 7.
 7. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is not OK, proceed with step 8.
 - If the voltage is OK, proceed with step 9.
 8. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.
 9. Check the CAN wiring between J19 of the S0008009 Dual Speed Starter and J7 of the A3640-XX Control board:
 - If the cable is defective, replace it.
 - If the cable is OK, proceed with step 10.
 10. Check the main storage capacitors, IGBTs and DC-BUS.
 - If any of them is defective, replace it.
 - If main storage capacitors, IGBTs and DC-BUS are OK, replace the S0008007 Booster module.

ERROR CODE: E133 CAN CONTROLLER INITIALIZATION

DESCRIPTION : The starter microcontroller has detected an error while initializing the CAN controller.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.
APPEARS WHEN : During the startup sequence.
LED CODE : 08 HEX



POSSIBLE CAUSES

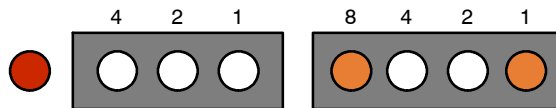
Power Supply out of boundaries.
 The S0008009 Dual Speed Starter is defective.
 The A3640-XX Control board is defective.

ACTIONS

1. Follow the procedure described for E130 (CAN Watchdog).

ERROR CODE: E134 MICROCONTROLLER POWER SUPPLY

DESCRIPTION :	The voltage supply for the microcontroller U21 is out of $5V^{\text{nom}} \pm 10\%$.
ERROR TYPE :	"Unrecoverable", the system remains lock.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	Anytime.
LED CODE :	09 HEX



POSSIBLE CAUSES

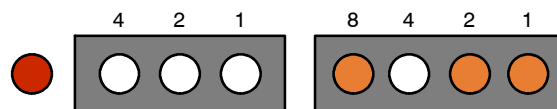
- The Power Supply is unbalanced.
- The A3646-XX Power Supply board is defective.
- The S0008009 Dual Speed Starter is defective.

ACTIONS

- Press reset to restore the error code and check again.
- If the error persists, check the voltage on TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (refer to Illustration 4-15).
 - If the voltage measured on TP41 is correct, replace the S0008009 Dual Speed Starter.
 - If the voltage measured on TP41 is not correct, proceed with step 3.
- Check the voltage ($+5.15V \pm 100mV$) in the A3646-XX Supply board (refer to Section 2.3).
 - If the voltage in the A3646-XX Supply board is correct, proceed with step 4.
 - If the voltage in the A3646-XX Supply board is not correct, proceed with step 5.
- Check the cable connected from J21 of the S0008009 Dual Speed Starter to J16 of the A3646-XX Supply board.
 - If the cable is OK, replace the S0008009 Dual Speed Starter.
 - If the cable is defective, replace it.
- Check the voltage in the Power Supply.
 - If the voltage is not OK, try to adjust the Power Supply potentiometer (refer to Section 2.3) to get $+5.15V \pm 100mV$. If it is not possible to adjust this voltage, replace the Power Supply.
 - If the voltage is OK and the error persists, proceed with step 6.
- Check the cable connected from J2 of the Power Supply to J14 of the A3646-XX Supply board.
 - If the cable is OK, replace the A3646-XX Supply board.
 - If the cable is defective, replace it.

ERROR CODE: E136 +15V POWER SUPPLY

DESCRIPTION :	The voltage supply is out of $15V^{nom} \pm 10\%$.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	Anytime.
LED CODE :	0B HEX

**POSSIBLE CAUSES**

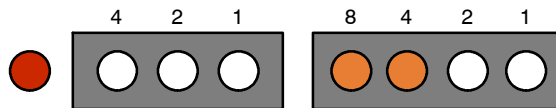
- The Power Supply is unbalanced.
- The A3646-XX Power Supply board is defective.
- The S0008009 Dual Speed Starter is defective.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check the voltage in TP39 ($+14.9V \pm 800mV$) on the S0008009 Dual Speed Starter.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 3.
3. Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 4.
4. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 5.
5. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.

ERROR CODE: E137 BOOSTER ERROR

DESCRIPTION :	High speed module (booster) not detected.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing "Prep" or during exposure.
LED CODE :	0C HEX



POSSIBLE CAUSES

- High speed module is defective.
- The ribbon cable is defective.

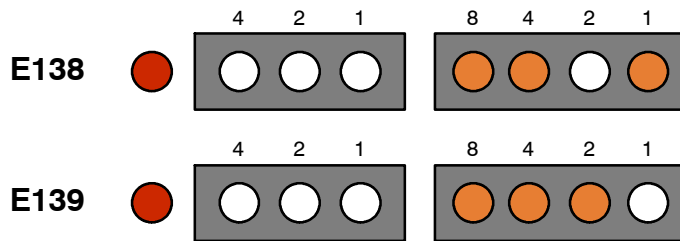
ACTIONS

- Press reset to restore the error code and check again.
- Check the ribbon cable between J1 of the S0008007 Booster module and J5 of the S0008009 Dual Speed Starter.
 - If the ribbon cable is defective, replace it.
 - If the ribbon cable is OK, proceed with step 3.
- Check L2 inductance by measuring the resistance between the cables connected to J12 and J13 (the resistance must be $\approx 0 \Omega$).
 - If L2 inductance is defective, replace it.
 - If L2 inductance is OK, proceed with step 4.
- Check the voltage on TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (refer to Illustration 4-15).
 - If the voltage is not OK, proceed with step 5.
 - If the voltage is OK, proceed with step 8.
- Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 6.
- Check the voltage in the A3646-XX Supply board (refer to Section 2.3).
 - If the voltage is not OK, proceed with step 7.
 - If the voltage is OK, proceed with step 8.
- Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the power supply potentiometer to get $+5.15V \pm 100mV$ (refer to Section 2.3).
 - If the voltage is OK, replace the A3646-XX Supply board.

8. Check the CAN wiring between J19 of the S0008009 Dual Speed Starter and J7 of the A3640-XX Control board:
 - If the cable is defective, replace it.
 - If the cable is OK, proceed with step 9.
9. Check U12 sensor on the S0008007 Booster module.
 - If U12 sensor is defective, replace the S0008007 Booster module.
 - If U12 sensor is OK, proceed with step 10.
10. Check the Main Storage Capacitors, IGBTs and DC-BUS.
 - If any of them is defective, replace it.
 - If the Main Storage Capacitors, IGBTs and DC-BUS are OK, proceed with step 11.
11. Check the connection of the Anode and Cathode cables from the HV Transformer to the X-ray Tube, making sure they are connected to the corresponding receptacles.
 - If the HV cables are not properly connected, connect the cables correctly, maintaining correct Anode and Cathode orientation.
 - If the Tube connections are correct and the error persists, proceed with step 12.
12. Check that the Tube is in proper conditions:
 - If the X-ray Tube is defective, replace it.
 - If the X-ray Tube is in proper conditions, replace the S0008007 Booster module.

ERROR CODE: E138 STARTER INVERTER ERROR (LED CODE 0D HEX)
E139 INVERTER FAILURE (LED CODE 0E HEX)

DESCRIPTION : The starter microcontroller has detected an error in its power module.
ERROR TYPE : “Unrecoverable”, the system remains lock.
APPLICABLE TO : All Generators.
LED CODE : Indicated with the corresponding Error Code (*refer to Section 4.1 to read LED Code*).



POSSIBLE CAUSES

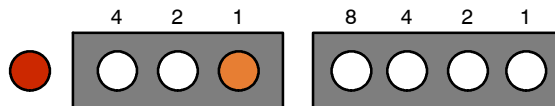
- Power Supply is out of boundaries.
- Defective Starter hardware.

ACTIONS

1. Check the voltage in TP30 (-15V ± 750mV), TP39 (+14.9V ± 800mV) and TP41 (+5.15V ± 100mV) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage is not OK, proceed with step 2.
 - If the voltage is OK, proceed with step 5.
2. Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 3.
3. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is not OK, proceed with step 4.
 - If the voltage is OK, proceed with step 5.
4. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.
5. Check J7 and J10 connections of the S0008009 Dual Speed Starter to ensure the wiring is OK and the screws are tight.
 - If any of the cables is defective, replace it.
 - If J7 and J10 connections are OK and the error persists, replace the S0008009 Dual Speed Starter.

ERROR CODE: E141 μ CONTROLLER WATCHDOG

DESCRIPTION : A μ C watchdog has occurred
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.
APPEARS WHEN : Anytime.
LED CODE : 10 HEX



POSSIBLE CAUSES

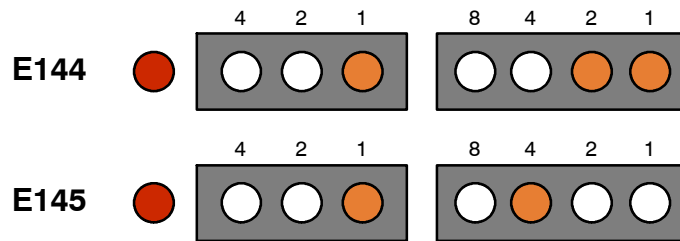
Can cable is defective or disconnected.
 Defective Dual Speed Starter board.

ACTIONS

1. Follow the procedure described for E130 (CAN Watchdog).

ERROR CODE: E144 MAIN CURRENT (LED CODE 13 HEX)
E145 AUX CURRENT (LED CODE 14 HEX)

DESCRIPTION : Stator winding current out of margin.
ERROR TYPE : “Unrecoverable”, the system remains lock.
APPLICABLE TO : All Generators.
LED CODE : Indicated with the corresponding Error Code (*refer to Section 4.1 to read LED Code*).



POSSIBLE CAUSES

The Tube model downloaded to the generator is not correct.
 Stator cables are disconnected or swapped.
 Power Supply out of boundaries.
 Dual Speed Starter is defective.

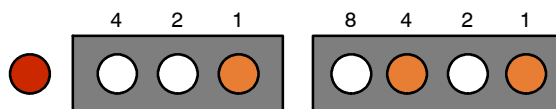
ACTIONS

1. Verify the tube selected in the Service Console (*refer to the Configuration document*).
 - If the Tube does not match the installed one in the system, modify the Tube selection or use the Tube's downloader to download the right Tube (*refer to the Configuration document*).
 - If the Tube selection is correct and the error persists, proceed with step 2.
2. Check the connection of the stator wiring (TS1 connector).
 - If the stator wiring connections are not correct, connect them properly.
 - If the connections are correct and the error persists, proceed with step 3.
3. Check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 4.
4. Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 5.
5. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 6.

6. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.

ERROR CODE: E146 TUBE CODE OR NUMBER

DESCRIPTION :	Not used.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.
LED CODE :	15 HEX



POSSIBLE CAUSES

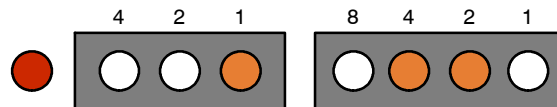
- Tube index is empty.
- The Tube model downloaded to the generator is not correct.

ACTIONS

- Press reset to restore the error code and check again.
- If the error persists, verify the tube selected in the Service Console (*refer to the Configuration document*).
 - If the Tube does not match the installed one in the system or an empty index has been selected, modify the Tube selection or use the Tube's downloader to download the right Tube (*refer to the Configuration document*).
 - If the Tube selection is correct and the error persists, get in contact with the manufacturer to get a new Tube catalog file.

ERROR CODE: E147 TUBE CONNECTION

DESCRIPTION :	The tube stator connections are wrong.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
LED CODE :	16 HEX

**POSSIBLE CAUSES**

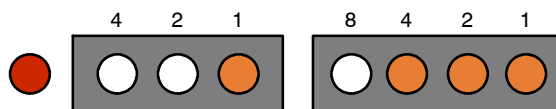
- Stator cables are disconnected, swapped or defective.
- The Tube model downloaded to the generator is not correct.
- The X-ray Tube is defective.
- The S0008009 Dual Speed Starter is defective.
- The A3646-XX Supply board is defective.
- The Power Supply is defective.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, download the Tube data again (*refer to the Configuration document*).
3. Check the stator resistance on the X-ray Tube between Main and Com, Main and Aux and Aux and Com.
 - If the measurement is not correct, replace the X-ray Tube.
 - If the measurement is correct, proceed with step 4.
4. Check the stator resistance on J7 of the S0008009 Dual Speed Starter.
 - If the measurement is not correct, replace the stator cable.
 - If the measurement is correct, proceed with step 5.
5. Get in contact with the manufacturer to get a new Tube catalog file.
6. If the error persists, check the voltage on TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 7.
7. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 8.
8. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.

ERROR CODE: E148 TUBE DEFINITION

DESCRIPTION :	The downloaded tube data are wrong.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence
LED CODE :	17 HEX



POSSIBLE CAUSES

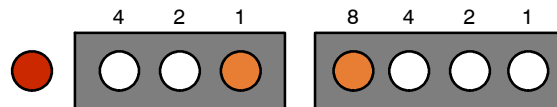
- Tube model downloaded to the generator is not correct.
- Tube model downloaded to the generator has been corrupted.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, download the Tube data again (*refer to the Configuration document*).
3. If the error persists, get in contact with the manufacturer to get a new Tube catalog file.

ERROR CODE: E149 BOOSTER DISABLED

DESCRIPTION :	An error has occurred on the S0008007 Booster Module and it has been disabled.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
LED CODE :	18 HEX

**POSSIBLE CAUSES**

Booster has been disabled due to an error.

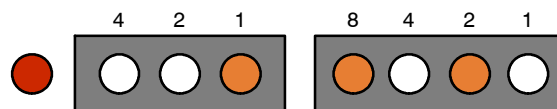
ACTIONS

- Press reset to restore the error code. Once the S0008007 Booster module is disabled, it remains disabled until the Generator is turned Off and On again.
- If the error persists after turning the Generator Off and On again, make sure that the S0008007 Booster module is properly connected.
- If the S0008007 Booster module is properly connected and the error persists, open the Service Console and check in the Licence Info if Booster is allowed (*refer to the Configuration document*).
 - If Booster is not allowed, get in contact with the manufacturer to get a new Licence.
 - If Booster is allowed, proceed with step 4.
- Disconnect the S0008007 Booster module. In order to do so:
 - Turn OFF the equipment and wait for the LP1 light of the S0008009 Dual Speed Starter to completely turn off (*refer to Illustration 4-12*).
 - Then, disconnect the ribbon cable from J1 of the S0008007 Booster module.
 - Finally, disconnect J7 connector from the S0008007 Booster module and from TS2 and place a jumper in TS2 between pins 1-4 and 2-3 (*refer to Illustration 4-13*).
- Turn ON the equipment again and select a low speed technique.
 - If the error disappears, replace the S0008007 Booster module.
 - If the error persists, proceed with step 6.
- Check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 7.
- Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 8.
- Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 9.

9. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.

ERROR CODE: E151 INITIAL TEST

DESCRIPTION :	Hardware error on Dual Speed Starter Module.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.
LED CODE :	1A HEX

**POSSIBLE CAUSES**

- Booster module is defective.
- Stator cables are disconnected or swapped.
- Power Supply out of boundaries.
- Dual Speed Starter is defective.

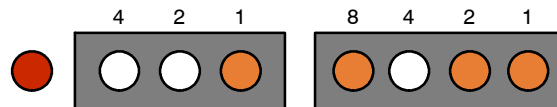
ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists and the Generator is equipped with the S0008007 Booster module, proceed with step 3. If the Generator is not equipped with Booster, proceed with step 5.
3. Disconnect the S0008007 Booster module. In order to do so:
 - a. Turn OFF the equipment and wait for the LP1 light of the S0008009 Dual Speed Starter to completely turn off (*refer to Illustration 4-12*).
 - b. Then, disconnect the ribbon cable from J1 of the S0008007 Booster module.
 - c. Finally, disconnect J7 connector from the S0008007 Booster module and from TS2 and place a jumper in TS2 between pins 1-4 and 2-3 (*refer to Illustration 4-13*).
4. Turn ON the equipment again.
 - If the error message disappears, replace the S0008007 Booster module.
 - If the error persists, proceed with step 5.
5. Check the right connection of the stator wiring (TS1 connector).
 - If the stator wiring connections are not correct, connect them properly.
 - If the connections are correct and the error persists, proceed with step 6.
6. Check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 7.
7. Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 8.

8. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 9.
9. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.

ERROR CODE: E152 STARTER TEST

DESCRIPTION :	Hardware error on Dual Speed Starter Module.
ERROR TYPE :	"Unrecoverable", the system remains lock.
APPLICABLE TO :	All Generators.
LED CODE :	1B HEX

**POSSIBLE CAUSES**

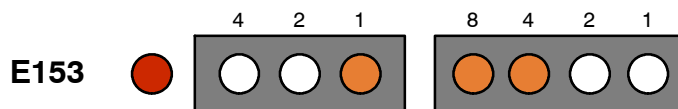
- Power Supply out of boundaries.
- Dual Speed Starter is defective.

ACTIONS

1. Check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (refer to Illustration 4-15).
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 2.
2. Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 3.
3. Check the voltage in the A3646-XX Supply board (refer to Section 2.3).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 4.
4. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.

ERROR CODE: E153 BOOSTER OVERVOLTAGE

DESCRIPTION :	A booster module overvoltage has occurred.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.
LED CODE :	1C HEX



POSSIBLE CAUSES

- Booster module is defective.
- IGBTs are defective
- Power Supply out of boundaries.
- Booster overvoltage caused by other error.
- Dual Speed Starter is defective

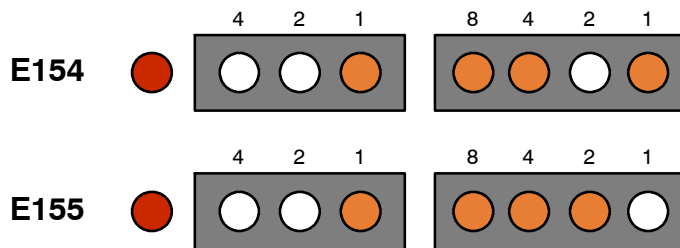
ACTIONS

1. Press reset to restore the error code and check again.
2. Check L2 inductance by measuring the resistance between the cables connected to J12 and J13 of the S0008007 Booster module (the resistance must be $\approx 0 \Omega$).
 - If L2 inductance is defective, replace it.
 - If L2 inductance is OK, proceed with step 3.
3. If the error persists, check U12 sensor and C15, C17, C21 and C23 capacitors on the S0008007 Booster module.
 - If any of this components is defective, replace the S0008007 Booster module.
 - If U12 sensor and C15, C17, C21 and C23 capacitors are OK, proceed with step 4.
4. Check IGBTs.
 - If the IGBTs are defective, replace them.
 - If the IGBTs are OK, proceed with step 5.
5. Check the ribbon cable between J1 of the S0008007 Booster module and J5 of the S0008009 Dual Speed Starter.
 - If the ribbon cable is defective, replace it.
 - If the ribbon cable is OK, proceed with step 6.
6. Check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (refer to Illustration 4-15).
 - If the voltage is not OK, proceed with step 7.
 - If the voltage is OK, proceed with step 10.
7. Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 8.

8. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is not OK, proceed with step 9.
 - If the voltage is OK, proceed with step 10.
9. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.
10. Disconnect the S0008007 Booster module. In order to do so:
 - a. Turn OFF the equipment and wait for the LP1 light of the S0008009 Dual Speed Starter to completely turn off (*refer to Illustration 4-12*).
 - b. Then, disconnect the ribbon cable from J1 of the S0008007 Booster module.
 - c. Finally, disconnect J7 connector from the S0008007 Booster module and from TS2 and place a jumper in TS2 between pins 1-4 and 2-3 (*refer to Illustration 4-13*).
11. Turn ON the equipment again and select a low speed technique.
 - If the error is solved, replace the S0008007 Booster module.
 - If the error code persists, replace the S0008009 Dual Speed Starter.
 - If the error code is replaced by another error code, follow the corresponding procedure described in this section with the S0008007 Booster module disconnected.

ERROR CODE: E154 BOOSTER OVERCURRENT (LED CODE 1D HEX)
E155 BOOSTER SHORTCUT (LED CODE 1E HEX)

DESCRIPTION : A booster module overvoltage has occurred.
ERROR TYPE : “Recoverable” with the Reset command.
APPLICABLE TO : All Generators.
APPEARS WHEN : During the startup sequence or when pressing “Prep”.
LED CODE : Indicated with the corresponding Error Code (*refer to Section 4.1 to read LED Code*)



POSSIBLE CAUSES

- The ribbon cable is defective.
- Power Supply out of boundaries.
- Booster module is defective.
- Booster overvoltage caused by other error.
- Dual Speed Starter is defective

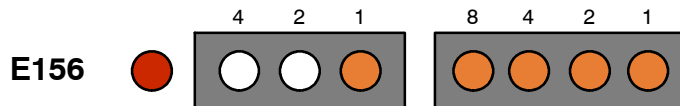
ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check the ribbon cable between J1 of the S0008007 Booster module and J5 of the S0008009 Dual Speed Starter.
 - If the ribbon cable is defective, replace it.
 - If the ribbon cable is OK, proceed with step 3.
3. Make sure that connectors J6 and J7 of the S0008007 Booster module are properly connected.
4. If cable connections are OK, check the voltage on TP30 (-15V ±750mV), TP39 (+14.9V ±800mV) and TP41 (+5.15V ±100mV) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*)..
 - If the voltage is not OK, proceed with step 5.
 - If the voltage is OK, proceed with step 8.
5. Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 6.

6. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is not OK, proceed with step 7.
 - If the voltage is OK, proceed with step 8.
7. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.
8. Disconnect the S0008007 Booster module. In order to do so:
 - a. Turn OFF the equipment and wait for the LP1 light of the S0008009 Dual Speed Starter to completely turn off (*refer to Illustration 4-12*).
 - b. Then, disconnect the ribbon cable from J1 of the S0008007 Booster module.
 - c. Finally, disconnect J7 connector from the S0008007 Booster module and from TS2 and place a jumper in TS2 between pins 1-4 and 2-3 (*refer to Illustration 4-13*).
9. Turn ON the equipment again and select a low speed technique.
 - If the error is solved, replace the S0008007 Booster module.
 - If the error code persists, replace the S0008009 Dual Speed Starter.
 - If the error code is replaced by another error code, follow the corresponding procedure described in this section with the S0008007 Booster module disconnected.

ERROR CODE: E156 ROTOR BETWEEN MEASURE

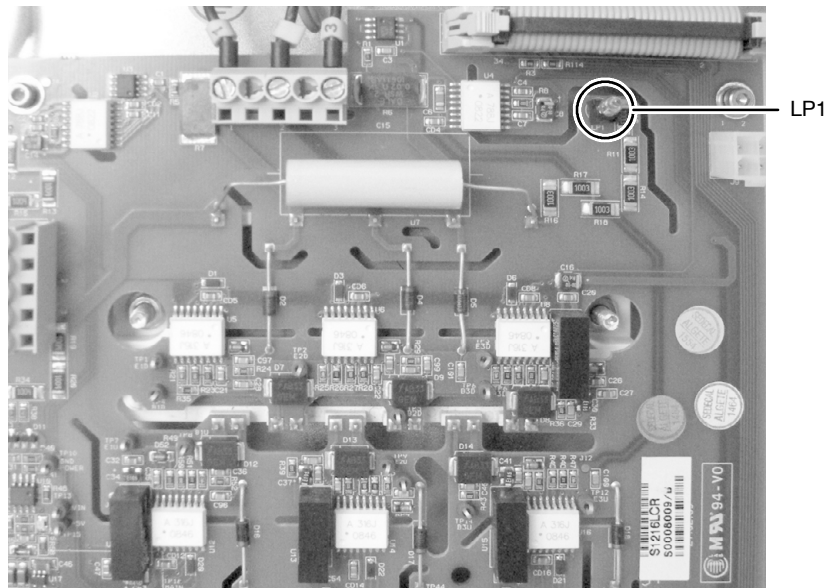
DESCRIPTION : Not used.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.
APPEARS WHEN :
LED CODE : 1F HEX



POSSIBLE CAUSES

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check that the LP1 light of the S0008009 Dual Speed Starter is lighting.



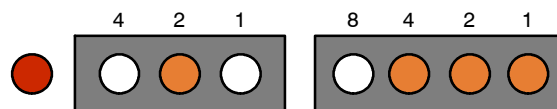
3. Check the tube condition.

4. Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 5.
5. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 6.
6. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.

5. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 6.
6. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.

ERROR CODE: E164 BOOSTER DISABLED

DESCRIPTION :	An error has occurred on the Booster module and it has been disabled.
ERROR TYPE :	"Recoverable" with the Reset command.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	When pressing "Prep" right after another error that has disabled the Booster.
LED CODE :	27 HEX

**POSSIBLE CAUSES**

Booster has been disabled due to an error.

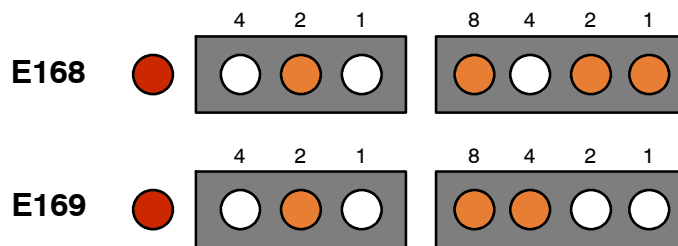
ACTIONS

- Press reset to restore the error code. Once the S0008007 Booster module is disabled, it remains disabled until the Generator is turned Off and On again.
- If the error persists after turning the Generator Off and On again, make sure that the S0008007 Booster module is properly connected.
- If the S0008007 Booster module is properly connected and the error persists, open the Service Console and check in the Licence Info if Booster is allowed (*refer to the Configuration document*).
 - If Booster is not allowed, get in contact with the manufacturer to get a new Licence.
 - If Booster is allowed, proceed with step 4.
- Disconnect the S0008007 Booster module. In order to do so:
 - Turn OFF the equipment and wait for the LP1 light of the S0008009 Dual Speed Starter to completely turn off (*refer to Illustration 4-12*).
 - Then, disconnect the ribbon cable from J1 of the S0008007 Booster module.
 - Finally, disconnect J7 connector from the S0008007 Booster module and from TS2 and place a jumper in TS2 between pins 1-4 and 2-3 (*refer to Illustration 4-13*).
- Turn ON the equipment again and select a low speed technique.
 - If the error disappears, replace the S0008007 Booster module.
 - If the error persists, proceed with step 6.
- Check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 7.
- Check fuse F3 on the A3646-XX Supply board.
 - If fuse F3 is blown, replace it.
 - If fuse F3 is OK, proceed with step 8.

8. Check the voltage in the A3646-XX Supply board (*refer to Section 2.3*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is OK, replace the S0008009 Dual Speed Starter.
 - If the voltage is not OK, proceed with step 9.
9. Check the voltage in the Power Supply.
 - If the voltage is not OK, adjust the Power Supply potentiometer.
 - If the voltage is OK, replace the A3646-XX Supply board.

ERROR CODE: E168 1ST PULSE PWM WARNING (LED CODE 2B HEX)
E169 LINEAR PWM WARNING (LED CODE 2C HEX)

DESCRIPTION : Not used.
ERROR TYPE : "Recoverable" with the Reset command.
APPLICABLE TO : All Generators.
APPEARS WHEN : During anode acceleration.
LED CODE : Indicated with the corresponding Error Code (*refer to Section 4.1 to read LED Code*)



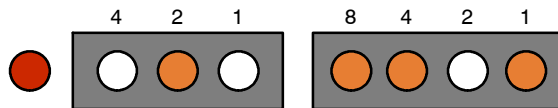
POSSIBLE CAUSES

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is not OK, check the voltage in the A3646-XX Supply board (*refer to Section 2.3*). Adjust the Power Supply potentiometer, if necessary.
 - If the voltage is OK, proceed with step 3.
3. Check connections between J7 of the A3640-XX Control board and J19 of the S0008009 Dual Speed Starter.
 - If the CAN cable is defective, replace it.
 - If the CAN cable is OK, proceed with step 4.
4. Check the ribbon cable between J1 of the S0008007 Booster module and J5 of the S0008009 Dual Speed Starter.
 - If the ribbon cable is defective, replace it.
 - If the ribbon cable is OK, proceed with step 5.
5. Check the connection of the stator cables between TS1 and J7 of the S0008009 Dual Speed Starter.
 - If any of them is not correctly connected, connect it properly.
 - If any of them is defective, replace it.
 - If the stator connections are OK, proceed with step 6.
6. Measure the stator resistance. If the stator resistance is OK and the error persists, replace S0008009 Dual Speed Starter.

ERROR CODE: E170 COMMAND REJECTED

DESCRIPTION : Software error.
ERROR TYPE : "Recoverable", the system remains lock.
APPLICABLE TO : All Generators.
APPEARS WHEN : During the startup sequence or when pressing "Prep" and during exposure.
LED CODE : 2D HEX



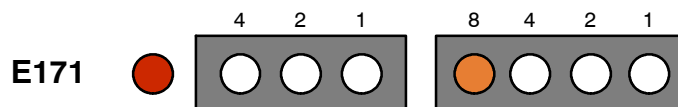
POSSIBLE CAUSES

ACTIONS

1. Follow the procedure described for E130 (CAN Watchdog).

ERROR CODE: E171 RESOURCES ERROR

DESCRIPTION :	Not used.
ERROR TYPE :	"Unrecoverable", the system remains lock.
APPLICABLE TO :	All Generators.
APPEARS WHEN :	During the startup sequence.
LED CODE :	08 HEX



POSSIBLE CAUSES

ACTIONS

1. Turn the Generator OFF and ON again.
2. If the error persists, check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is not OK, check the voltage in the A3646-XX Supply board (*refer to Section 2.3*). Adjust the Power Supply potentiometer, if necessary.
 - If the voltage is OK, proceed with step 3.
3. Check connections between J7 of the A3640-XX Control board and J19 of the S0008009 Dual Speed Starter.
 - If the CAN cable is defective, replace it.
 - If the CAN cable is OK, proceed with step 4.
4. Check the ribbon cable between J1 of the S0008007 Booster module and J5 of the S0008009 Dual Speed Starter.
 - If the ribbon cable is defective, replace it.
 - If the ribbon cable is OK, proceed with step 5.
5. Check J7 and J10 connections of the S0008009 Dual Speed Starter to ensure the wiring is OK and the screws are tight.
 - If any of the cables is defective, replace it.
 - If J7 and J10 connections are OK and the error persists, replace S0008009 Dual Speed Starter.

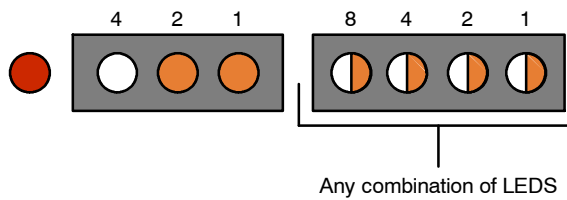
ERROR CODE:	E173	CAN INITIALIZATION (LED CODE 30 HEX)
	E174	CAN STUFF (LED CODE 31 HEX)
	E175	CAN FORM (LED CODE 32 HEX)
	E176	CAN ACK (LED CODE 33 HEX)
	E177	CAN BIT1 (LED CODE 34 HEX)
	E178	CAN BIT0 (LED CODE 35 HEX)
	E179	CAN CRC (LED CODE 36 HEX)
	E180	CAN INIT ID (LED CODE 37 HEX)
	E181	CAN BUS OFF (LED CODE 38 HEX)
	E182	CAN EWARN (LED CODE 39 HEX)
	E183	CAN OBJECT OUT OF RANGE (LED CODE 3A HEX)

DESCRIPTION : The CAN bus error is activated.

ERROR TYPE : "Recoverable" with the Reset command.

APPLICABLE TO : All Generators.

LED CODE : Indicated with the corresponding Error Code (*refer to Section 4.1 to read LED Code*)



POSSIBLE CAUSES

- CAN cable is defective.
- CAN cable is disconnected.

ACTIONS

1. Follow the procedure described for E130 (CAN Watchdog).

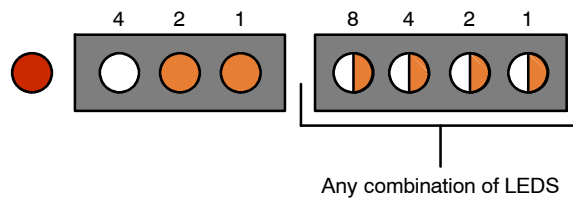
ERROR CODE:	E184	CAN OBJECT NOT USED (LED CODE 3B HEX)
	E185	CAN OBJECT MISMATCH (LED CODE 3C HEX)
	E186	CAN BUFFER FULL (LED CODE 3D HEX)
	E187	CAN SLAVE OUT OF RANGE (LED CODE 3E HEX)
	E188	CAN CONFIG PARAM (LED CODE 3F HEX)
	E189	CAN FORM MESSAGE (LED CODE 40 HEX)
	E190	CAN CONFIG MODIF OBJ1 (LED CODE 41 HEX)
	E191	CAN CONFIG MODIF OBJ2 (LED CODE 42 HEX)
	E192	CAN CONFIG MODIF OBJ3 (LED CODE 43 HEX)
	E193	CAN CONFIG MODIF OBJ4 (LED CODE 44 HEX)
	E194	CAN CONFIG MODIF OBJ5 (LED CODE 45 HEX)

DESCRIPTION : The CAN bus error is activated.

ERROR TYPE : "Recoverable" with the Reset command.

APPLICABLE TO : All Generators.

LED CODE : Indicated with the corresponding Error Code (*refer to Section 4.1 to read LED Code*)



POSSIBLE CAUSES

- CAN cable is defective.
- CAN cable is disconnected.

ACTIONS

1. Follow the procedure described for E130 (CAN Watchdog).

ERROR CODE:	E195	CAN CONFIG MODIF OBJ6	(LED CODE 46 HEX)
	E196	CAN CONFIG MODIF OBJ7	(LED CODE 47 HEX)
	E197	CAN CONFIG MODIF OBJ8	(LED CODE 48 HEX)
	E198	CAN CONFIG MODIF OBJ9	(LED CODE 49 HEX)
	E199	CAN CONFIG MODIF OBJ10	(LED CODE 4A HEX)
	E200	CAN CONFIG MODIF OBJ11	(LED CODE 4B HEX)
	E201	CAN CONFIG MODIF OBJ12	(LED CODE 4C HEX)
	E202	CAN CONFIG MODIF OBJ13	(LED CODE 4D HEX)
	E203	CAN CONFIG MODIF OBJ14	(LED CODE 4E HEX)
	E204	CAN CONFIG MODIF OBJ15	(LED CODE 4F HEX)

DESCRIPTION :

The CAN bus error is activated.

ERROR TYPE :

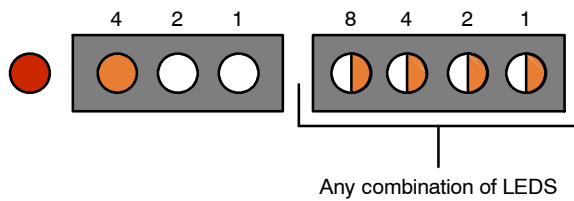
“Recoverable” with the Reset command.

APPLICABLE TO :

All Generators.

LED CODE :

Indicated with the corresponding Error Code (*refer to Section 4.1 to read LED Code*)



POSSIBLE CAUSES

- CAN cable is defective.
- CAN cable is disconnected.

ACTIONS

1. Follow the procedure described for E130 (CAN Watchdog).

ERROR CODE: E238 STARTER NOT RESPONDING

DESCRIPTION :	The starter is not answering the status queries from the main controller.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- Can cable is defective or disconnected.
- Defective Dual Speed Starter board.

ACTIONS

1. Press reset to restore the error code and check again.
2. If the error persists, verify that the CAN cable is properly connected to J19 of the S0008009 Dual Speed Starter.
3. If the CAN cable is properly connected, check the CAN wiring between J19 of the S0008009 Dual Speed Starter and J7 of the A3640-XX Control board:
 - If the cable is defective, replace it.
 - If the cable is in proper condition, proceed with step 4.
4. Check the voltage in TP30 ($-15V \pm 750mV$), TP39 ($+14.9V \pm 800mV$) and TP41 ($+5.15V \pm 100mV$) on the S0008009 Dual Speed Starter (*refer to Illustration 4-15*).
 - If the voltage measured in the A3646-XX Supply board oscillates, replace the Power Supply.
 - If the voltage is not OK, check the voltage in the A3646-XX Supply board (*refer to Section 2.3*). Adjust the Power Supply potentiometer, if necessary.
 - If the voltage is OK and the error persists, replace the S0008009 Dual Speed Starter.

ERROR CODE: E239 STARTER OVERLOAD ERROR

DESCRIPTION :	The Starter module has been overloaded.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

- The Starter module has been overloaded because too many accelerations have been demanded within one minute.

ACTIONS

1. Wait one minute to recover the starter functionality.
2. Check the starter configuration and make sure it matches the installation needs.

ERROR CODE: E240 STARTER TUBE INDEX ERROR

DESCRIPTION :	The starter has received a wrong index from the main controller.
ERROR TYPE :	“Recoverable” with the Reset command.
APPLICABLE TO :	All Generators.

POSSIBLE CAUSES

The starter has received an order to be executed on a tube different from the currently selected one.
It could be related to a software bug or communication problems.

ACTIONS

1. Check the ribbon cable between the A3640-XX Control board and the S0008009 Dual Speed Starter.

ERROR CODE: RAM MEMORY ERROR

DESCRIPTION :	Microcontroller memory fault. Only displayed on the Control board LEDs.
ERROR TYPE :	“Unrecoverable”, the system restarts again after 3 seconds.
APPLICABLE TO :	All Generators.
LED CODE :	DS27 (RED) + DS23, DS28 and DS24 (YELLOW).

POSSIBLE CAUSES

Defective microcontroller RAM memory.

ACTIONS

1. If the error persists, replace the defective hardware.

ERROR CODE: NON VOLATILE RAM (NVRAM) MEMORY ERROR

DESCRIPTION :	Non volatile memory fault. Only displayed on the Control board LEDs.
ERROR TYPE :	"Unrecoverable", the system restarts again after 3 seconds.
APPLICABLE TO :	All Generators.
LED CODE :	DS27 (RED) + DS29, DS25 and DS30 (YELLOW).

POSSIBLE CAUSES

Defective non volatile RAM memory.

ACTIONS

1. If the error persists, replace the defective hardware.

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SECTION 5**DISASSEMBLY/REASSEMBLY
PROCEDURES**

Whenever the HV Transformer or X-ray Tube is replaced in the Generator, the respective configuration and calibration procedures must be performed.

If the A3640-XX Control board is replaced, restore the configuration and AEC data from the backup files saved in the computer and perform the required calibration procedures, or transfer the U66-EEPROM from the old board to the new board and perform the calibration procedures. U66-EEPROM contains configuration and calibration data.

If the backup files cannot be restored and U66-EEPROM is not transferred, complete configuration procedure must be performed.

Update and record in the Data Book any new calibration data.



Use the Anti-static Protection Device for handling when replacing any board or electronic part.



BEFORE REPLACING ANY PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.



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 BEFORE SERVICING THE EQUIPMENT (APPROX. 3 MINUTES AFTER THE UNIT IS TURNED OFF).



TO AVOID ELECTRIC SHOCK, 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.



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.



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 ALTHOUGH THE GENERATOR IS OFF. BE SURE THAT THE SAFETY SWITCH IS OFF BEFORE HANDLING ANY INTERNAL PART OF THE EQUIPMENT.

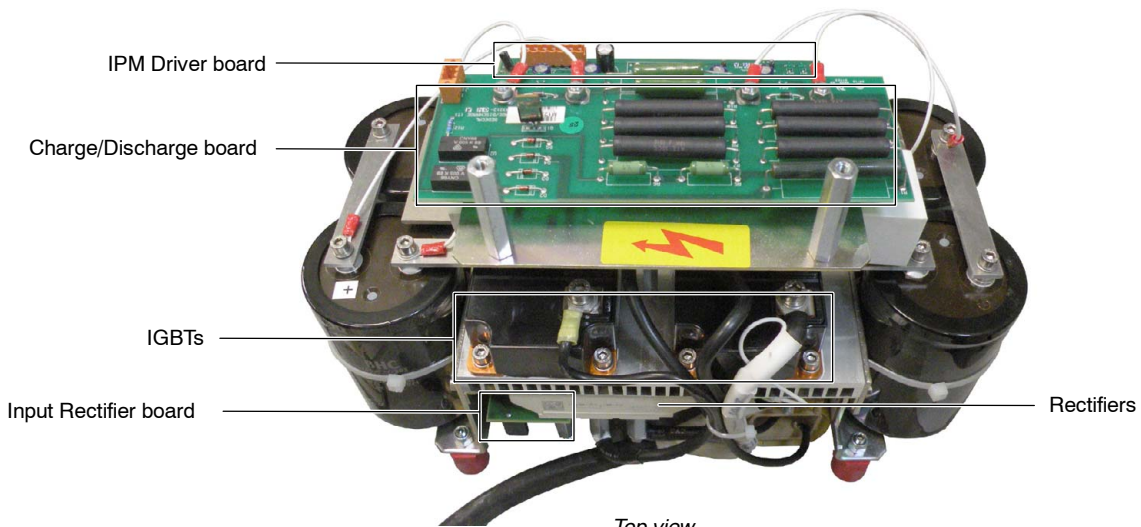
JOB CARD LIST	
JOB CARD	DESCRIPTION
INVERTER MODULE	
Job Card 1.1	Inverter Module
Job Card 1.2	Input Rectifier (A3255-XX)
Job Card 1.3	Rectifiers on the Inverter Module
Job Card 1.4	Main Storage Capacitors
Job Card 1.5	Charge/Discharge Board (A3212-XX)
Job Card 1.6	IPM Driver Board (A3063-XX)
Job Card 1.7	IGBTs in the Inverter Module
TANK	
Job Card 2.1	High Voltage Tank
FRONT PANEL	
Job Card 3.1	Control Board (A3640-XX)
Job Card 3.2	Interface Board (A3674-XX)
BACK PANEL	
Job Card 4.1	Dual Speed Starter (S0008009)
Job Card 4.2	Booster Module (S0008007)
Job Card 4.3	Booster IGBT (S0009814)
Job Card 4.4	Supply Board (A3646-XX)
Job Card 4.5	Power Supply

JOB CARD 1.1: REPLACEMENT OF THE INVERTER MODULE

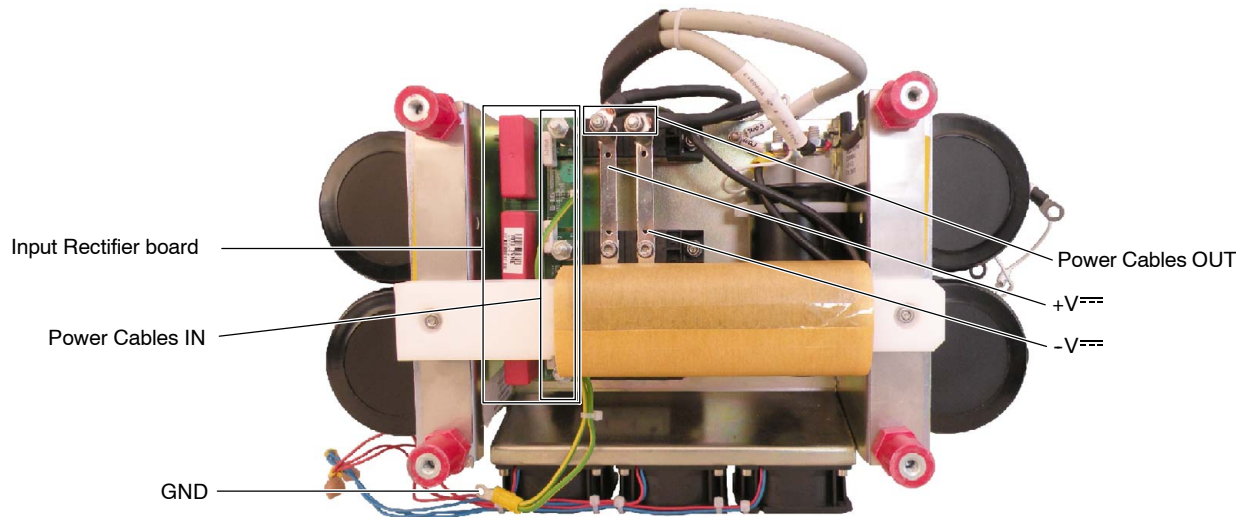
SUBASSEMBLY: INVERTER MODULE

TOOLS: Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.

PROCEDURE



Top view



Rear view

Note 

The code number of the Inverter Module depends on the Generator Model. Check labels for its identification.



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

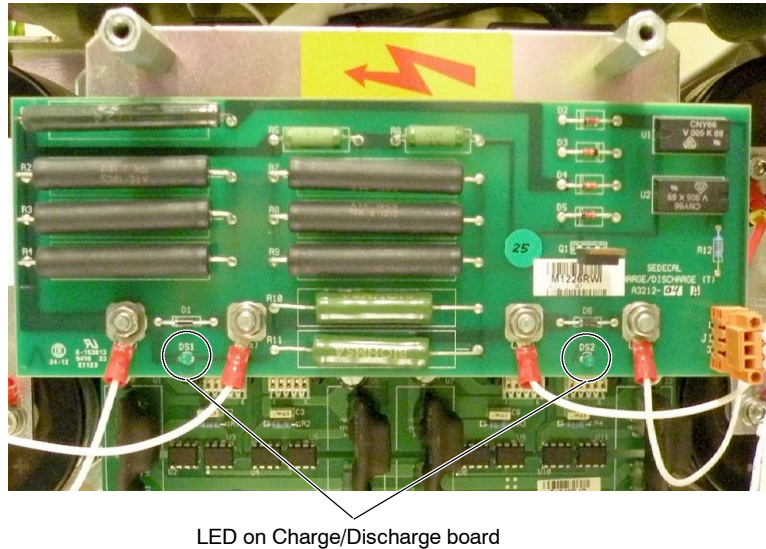
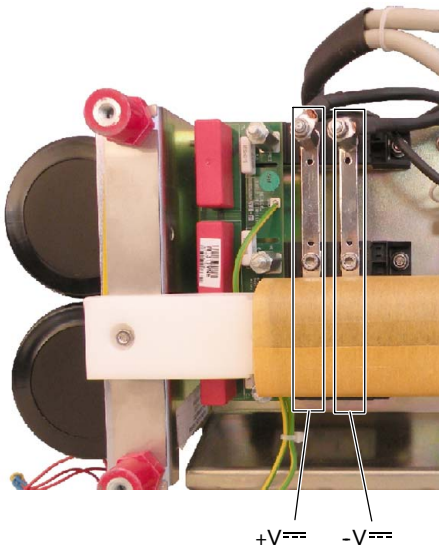


Use the Anti-static Protection Device for handling or replacing any board or electronic part.

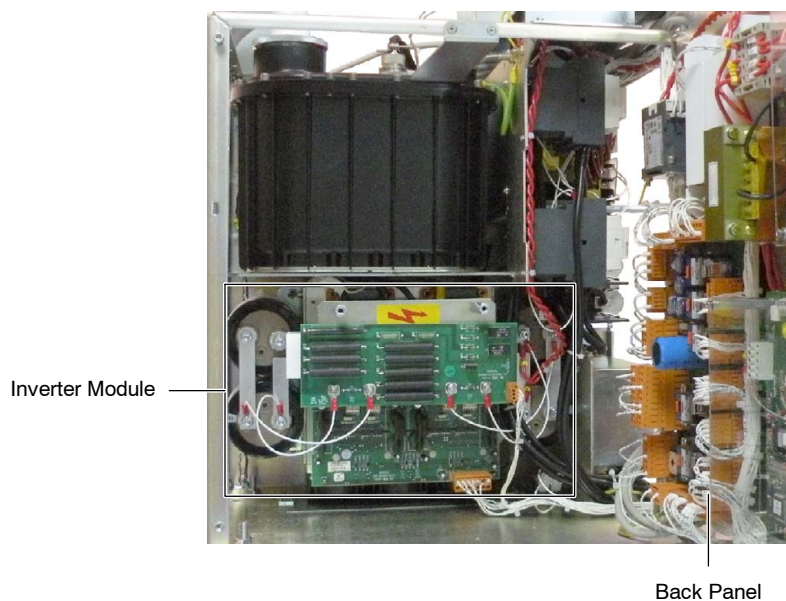
1. Remove the Generator Cabinet Covers and place the Generator where the rear panel can be accessed.
2. Remove the Generator Rear Cover taking care not to damage the Power line cables.
3. Remove the screw of the Generator Front Door and open it.
4. Remove the protective Plastic Safety Cover from the front of the Module inside the Generator.



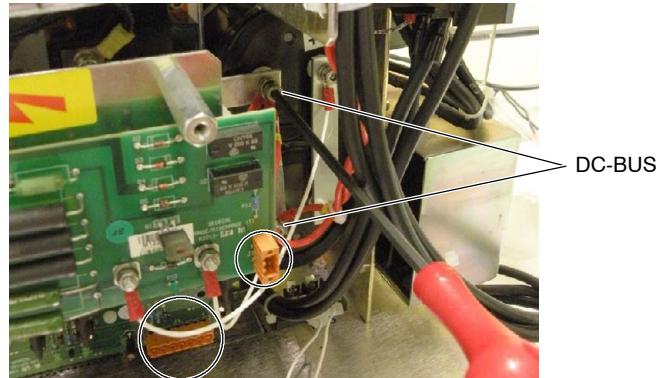
MAKE SURE THAT THE MAIN STORAGE CAPACITORS OF THE HIGH VOLTAGE INVERTER DO NOT CONTAIN ANY RESIDUAL CHARGE. WAIT UNTIL THE LIGHT EMITTING DIODES ON THE CHARGE/DISCHARGE BOARD ARE OFF, APPROXIMATELY 3 MINUTES AFTER THE UNIT IS TURNED OFF. CHECK THAT THE MEASURED VOLTAGE BETWEEN POSITIVE AND NEGATIVE DC VOLTAGE WIRES ON THE CHARGE/DISCHARGE BOARD IS $< 10\text{ V}_{\text{DC}}$.



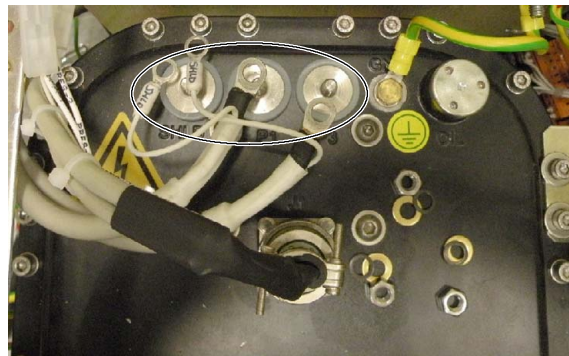
5. Place a white cloth below the inverter to easily find any screw, nut, spacer or washer that could drop down during the replacement.



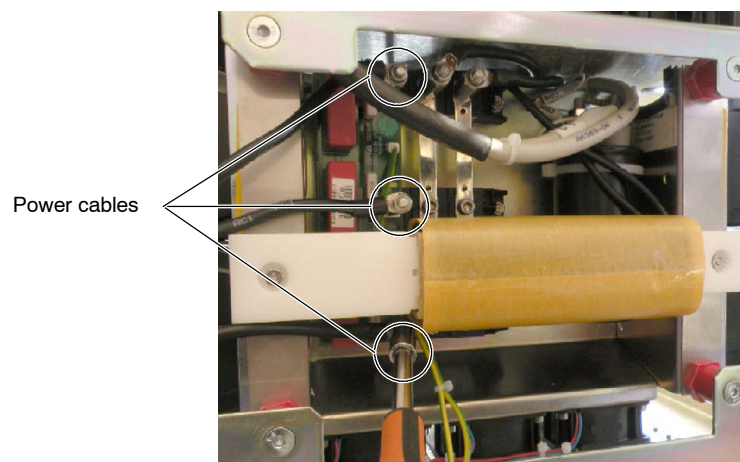
6. Disconnect the two connectors from the Charge/Discharge (J1) and from the IPM driver (J3) boards and remove the DC+ and DC- from the DC-BUS bars (refer to the following illustration).



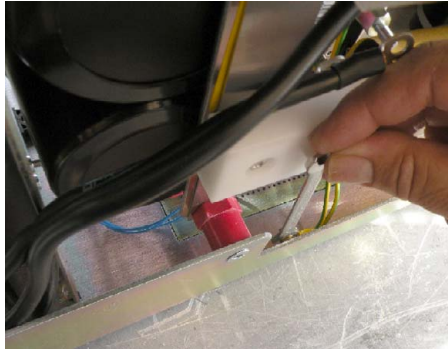
7. Label and disconnect the Cables from the HV Transformer (P1, P2-Shield, and P3).



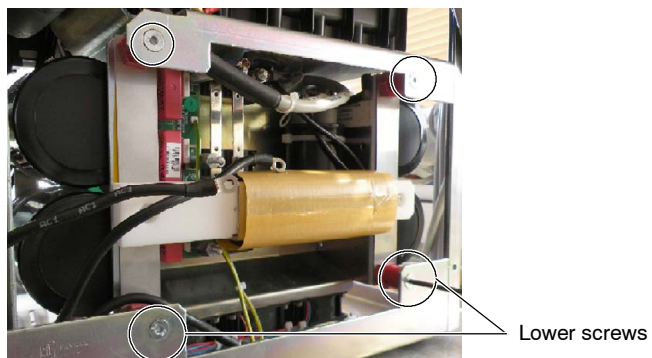
8. On the back side of the Cabinet, disconnect the Power cables from the Input Rectifier board holding the hexagonal spacer in place while unscrewing the connection. Disconnect also the GND wire.



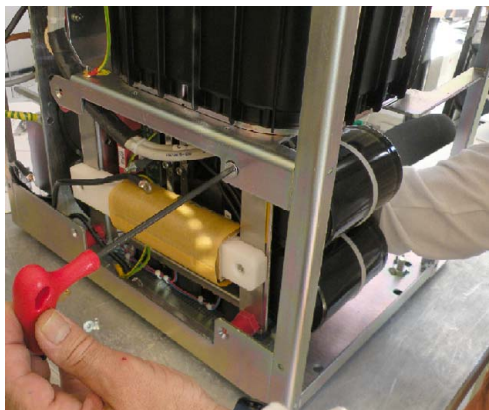
9. Use a wrench to disconnect the GND (yellow and green wires) attached to the chassis of the Generator from the Input Rectifier board, as shown in the photo below.



10. The most practical way of dismantling the Inverter Module from the Generator is by first removing the two lower screws and then loosening the two upper screws.



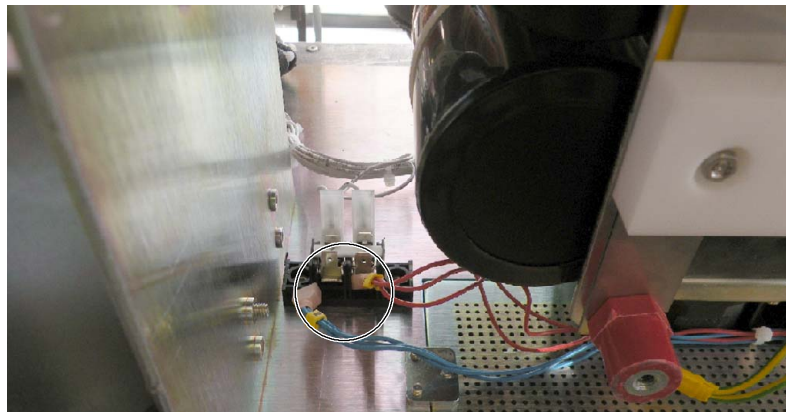
11. Hold the module with one hand (to keep the module from falling and potentially damaging the components underneath) while removing the already loosened upper screws of the Inverter Module.



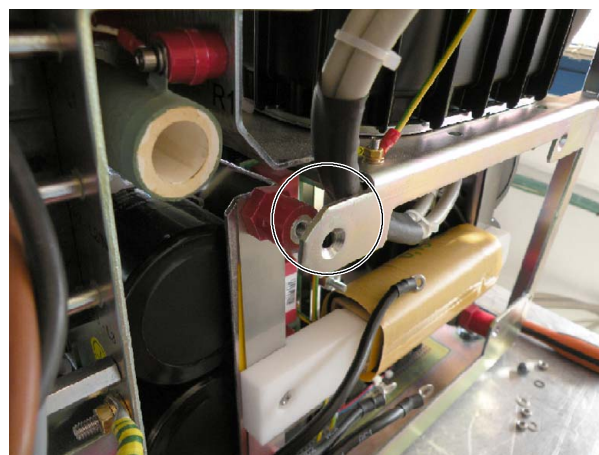


This module is heavy and must be removed through the front of the cabinet.

12. If the Inverter Module is equipped with fans, move the Inverter module to gain access to the supply wires of the fans and disconnect them from the terminal strip located at the back side of the Generator. Due to the polarity of the supply wires of the fans, note their positions in order to restore them properly when re-assembling the Inverter Module.



13. Remove the Inverter Module.
14. Install the new Inverter Module, placing the HV Tank cables in place before attaching the back screws with the nuts removed earlier.

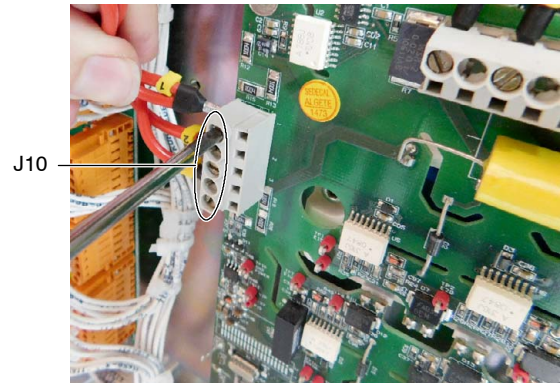
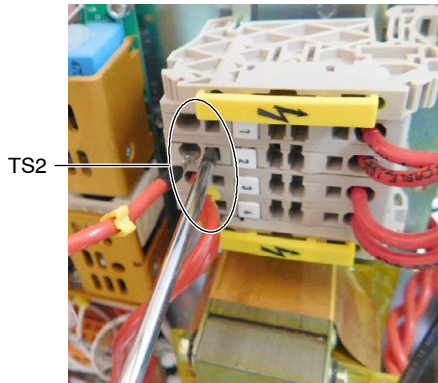


15. Connect all the wires and connectors, removed in the previous steps, to the Inverter Module.

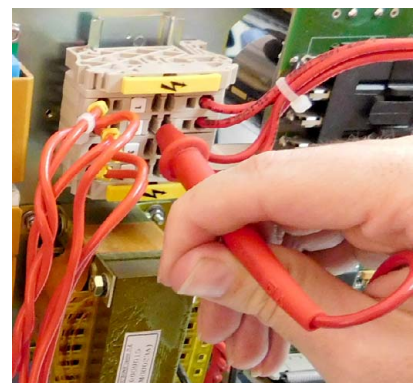
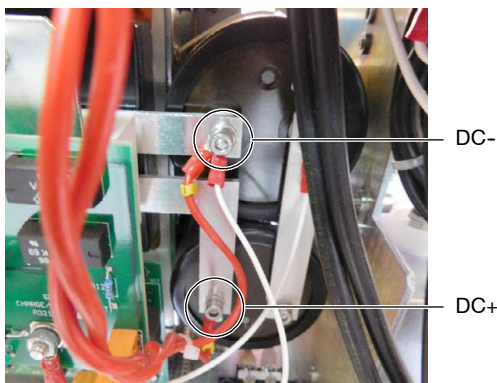


MAKE SURE THAT ALL CONNECTIONS ARE NOT ONLY SECURE BUT ALSO CORRECT.

16. In case the diameter of the ring terminals of the twisted pair cable does not match the diameter of the Capacitor screws, perform the following steps 17. to 19. Otherwise, proceed with step 20.
17. Remove all the Tie wraps from the twisted red cable and disconnect it from TS2-1, TS2-2, TS2-3 and TS2-4; and from J10 of the Dual Speed Starter.



18. Replace the previously removed cable with the one provided with the Inverter module and connect it to TS2, to the Dual Speed Starter and to the DC-BUS bars.
19. Check polarity of the wires:
 - a. For Generators equipped with Booster Module, check polarity from DC- to TS2-1, TS2-4 and J10-3; from DC+ to TS2-2 and J10-1; and from TS2-3 to J10-2.
 - b. For Generators without Booster Module, check polarity from DC- to TS2-1, TS2-4 and J10-3; and from DC+ to TS2-2, TS2-3, J10-1 and J10-2.



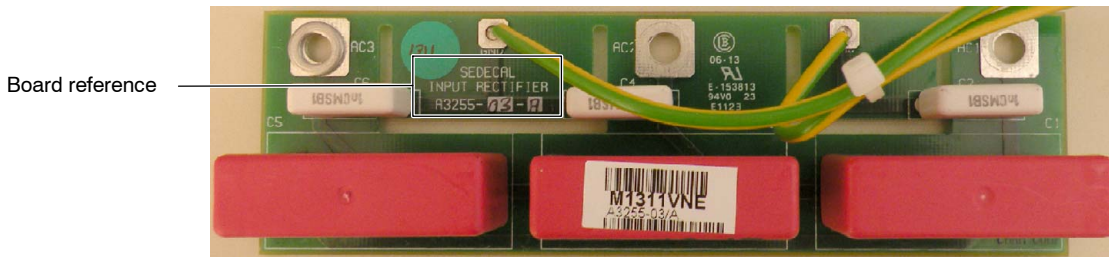
20. Reinstall the Protective Plastic Safety Cover at the front of the Inverter Module.
21. Remove the white cloth that was placed below the Inverter in step 5.
22. Close the Front Panel and secure it to the Generator Frame.
23. Switch ON the Generator, there should be no errors upon powering up. To check that the Inverter Module replacement has been performed successfully:
 - Measure RMS Voltage between 2 AC wires and measure DC voltage between DC bars and apply the following formula:
 $V(\text{DC}) = V_{\text{rms}} (\text{Line}) \times 1.41.$
The result of the previous formula should be equal or greater than the measured voltage between DC bars.
 - Make a few exposures and verify that there are X-rays to ensure proper functioning.
24. Note in the Data Book the cause and date of the replacement in order to provide the maximum information.
25. Reinstall the Back Cover and, finally, the Generator Cover.

JOB CARD 1.2: REPLACEMENT OF THE INPUT RECTIFIER

SUBASSEMBLY: INPUT RECTIFIER (A3255-XX).

TOOLS: Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.

PROCEDURE



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 ARE OFF, APPROXIMATELY 3 MINUTES AFTER THE UNIT IS TURNED OFF. CHECK THAT THE MEASURED VOLTAGE BETWEEN POSITIVE AND NEGATIVE DC VOLTAGE WIRES ON THE CHARGE/DISCHARGE BOARD IS $< 10 V_{DC}$.



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

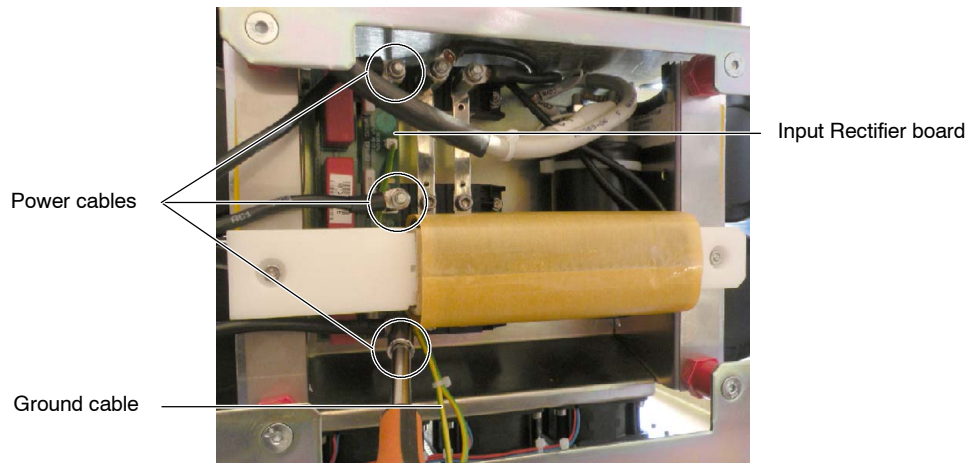
DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

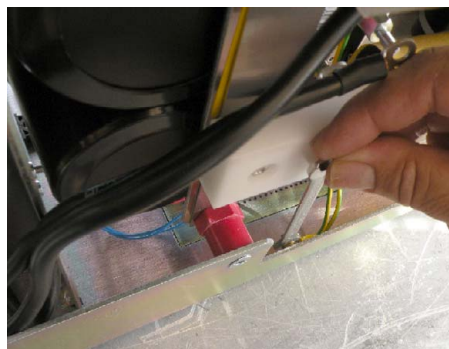


Use the Anti-static Protection Device for handling or replacing any board or electronic part.

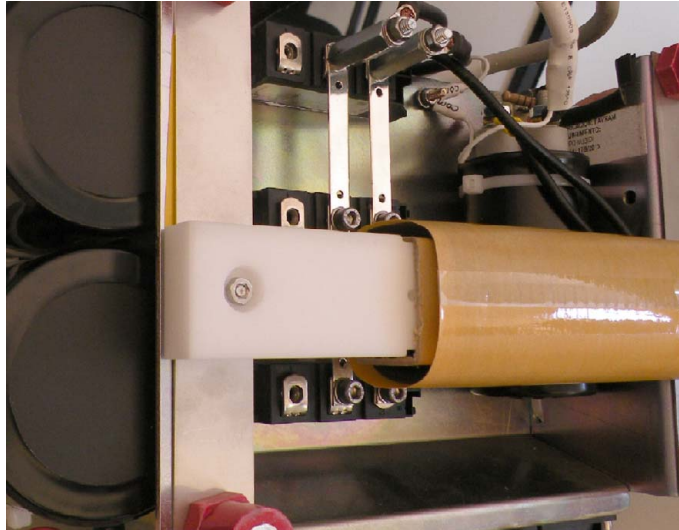
1. Remove the Generator Cover.
2. At the back side of the Cabinet, carefully remove the four Allen screws from the Back Cover of the Generator and remove the Back Cover taking care not to damage the Power line cables.
3. From the back side of the Cabinet, disconnect the Power cables from the Input Rectifier board holding the hexagonal spacer in place while unscrewing the connection.



4. With a socket wrench, disconnect the GND (yellow and green wires) attached to the chassis of the Generator from Input Rectifier board, as shown in the photo below.



5. Unscrew the hexagonal spacers, taking care not to lose the washers, in order to remove the Input rectifier board.
6. Replace the old board with the new one using the previously removed spacers and washers to hold it in place.



7. Reinstall the Ground Cable from the Input Rectifier board to the chassis of the Generator.
8. Reinstall the three Power cables on the Input Rectifier board with nuts and washers holding the hexagonal spacer in place while screwing the connection.
9. Note in the Data Book the cause and date of the replacement and fix an adhesive label in the new board indicating the date and the name of the field engineer in order to provide the maximum information.
10. Reinstall the Back Cover of the Generator and, finally, the Generator Cover.

JOB CARD 1.3: REPLACEMENT OF THE RECTIFIERS**SUBASSEMBLY:** RECTIFIERS ON THE INVERTER MODULE.**TOOLS:** Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.**PROCEDURE**

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 ARE OFF, APPROXIMATELY 3 MINUTES AFTER THE UNIT IS TURNED OFF. CHECK THAT THE MEASURED VOLTAGE BETWEEN POSITIVE AND NEGATIVE DC VOLTAGE WIRES ON THE CHARGE/DISCHARGE BOARD IS $< 10 V_{DC}$.



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

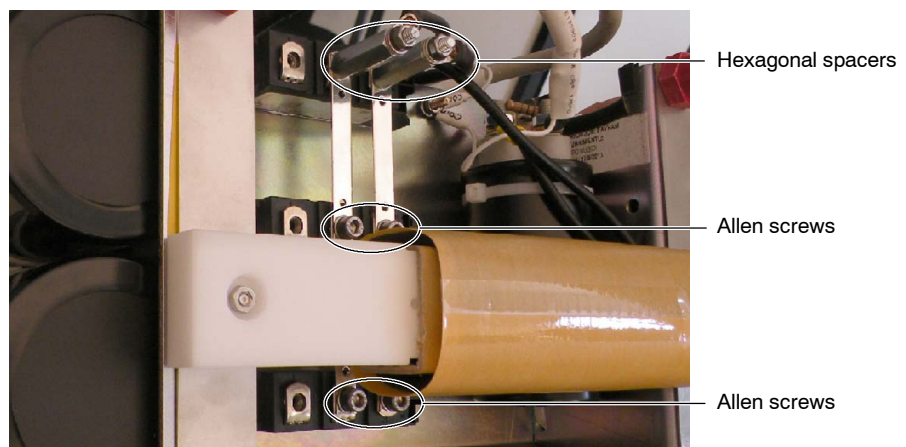
DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.



Use the Anti-static Protection Device for handling or replacing any board or electronic part.

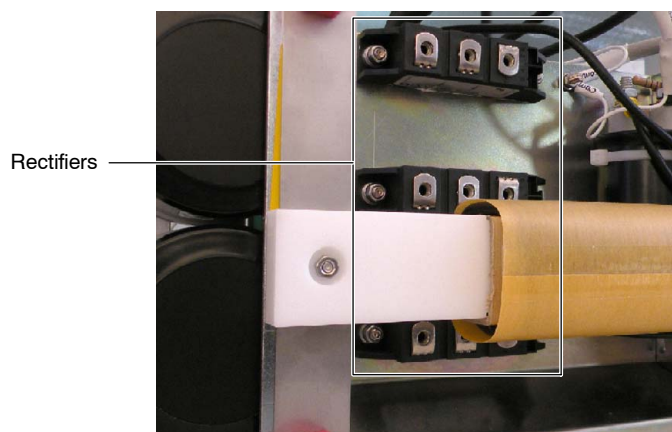
1. Remove the Input Rectifier board as described in the Job Card 1.2.
2. Label and disconnect the DC-BUS Wires (+) and (-) (Nuts and Washers) holding the hexagonal spacers in place while unscrewing the connection.
3. Remove the four Allen screws and the hexagonal spacers that fix the DC-BUS Bars (+) and (-) to the Rectifiers behind.



4. Remove the old Rectifiers and install the new ones. Each Rectifier is fixed to the Module by four washers and two nuts. Note the orientation of the Rectifiers.



Remove and replace the Rectifiers keeping the original orientation (+/-) in order to maintain the Polarity of the Unit.



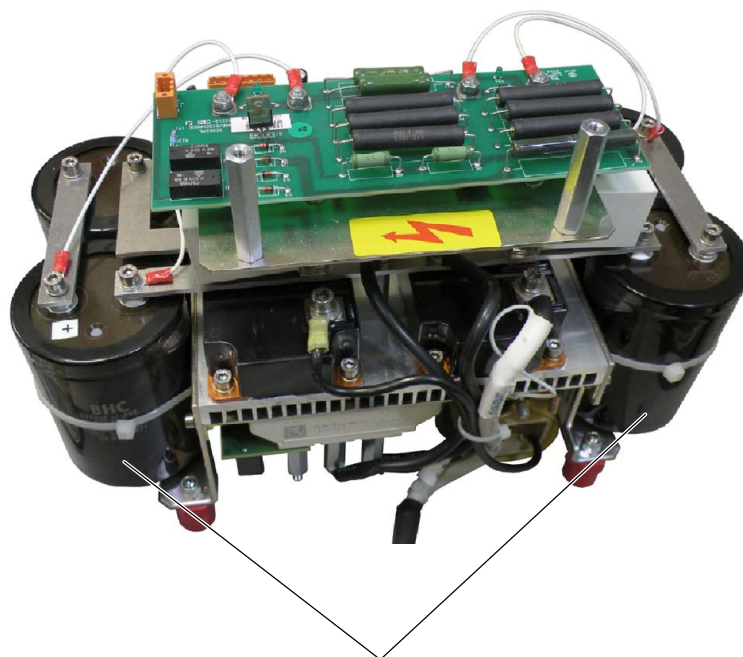
5. Install the DC-BUS Bars with their corresponding Allen screws and hexagonal spacers.
6. Connect the DC-BUS wires (+) and (-) removed before.
7. Reinstall the Input Rectifier board, ensuring that its position matches its original placement.
8. Note in the Data Book the cause and date of the replacement in order to provide the maximum information.
9. Follow with step 7. of the Job Card 1.2.

JOB CARD 1.4: REPLACEMENT OF THE MAIN STORAGE CAPACITORS OF THE HIGH VOLTAGE INVERTER

SUBASSEMBLY: MAIN STORAGE CAPACITORS.

TOOLS: Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.

PROCEDURE



Main Storage Capacitors
of the Inverter Module



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 ARE OFF, APPROXIMATELY 3 MINUTES AFTER THE UNIT IS TURNED OFF. CHECK THAT THE MEASURED VOLTAGE BETWEEN POSITIVE AND NEGATIVE DC VOLTAGE WIRES ON THE CHARGE/DISCHARGE BOARD IS $< 10 V_{DC}$.



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

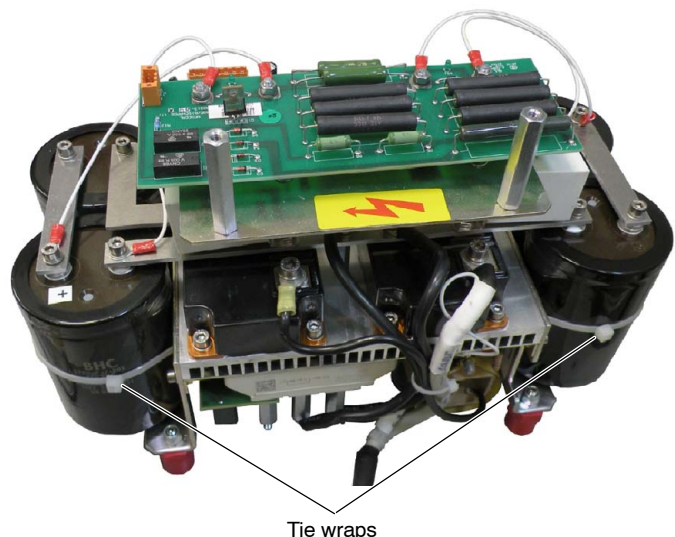
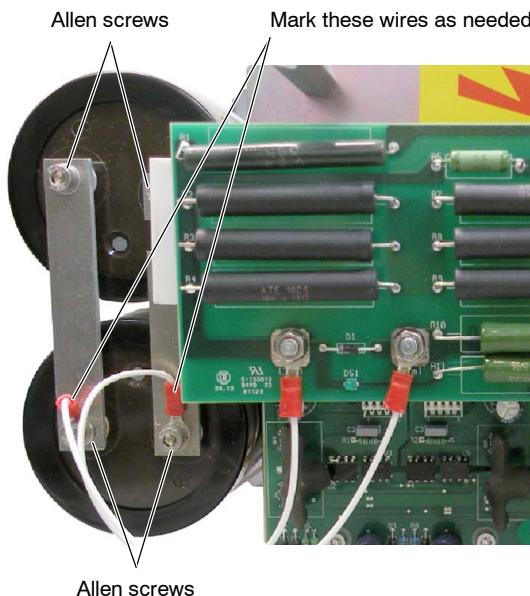
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ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.



Use the Anti-static Protection Device for handling or replacing any board or electronic part.

1. Remove the Inverter Module as described in the Job Card 1.1 from steps 1 to 13.
2. Position the Module face up in order to access the screws that secure each Storage Capacitor to the DC-BUS. Remove the two screws that fix the Capacitor to be replaced to the DC-BUS. If these screws serve as connections for wires from the Charge/Discharge board, mark the respective wire(s).

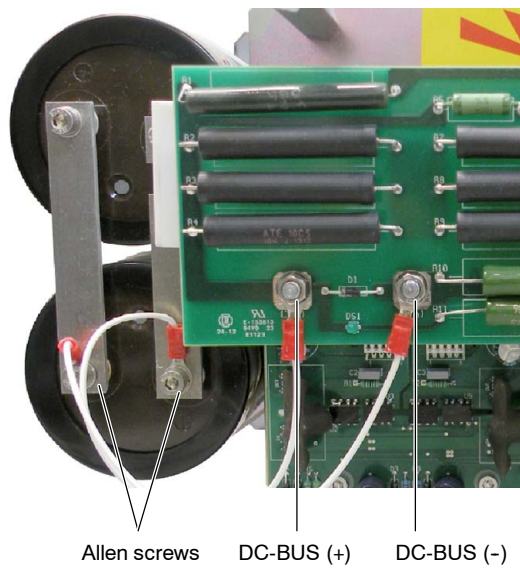


3. While holding the Capacitor to be replaced, cut the Tie wrap that holds the Capacitor to the Module.

4. Place a new Tie wrap through the holes provided in the Module.
5. Install the new Storage Capacitor, securing it to the DC-BUS with the two Allen screws. Reconnect any wires removed from the Charge/Discharge board, if needed.



MAKE SURE THAT THE DC-BUS WIRES (+) AND (-) ARE CONNECTED IN THE CORRECT SCREWS AND SECURED.



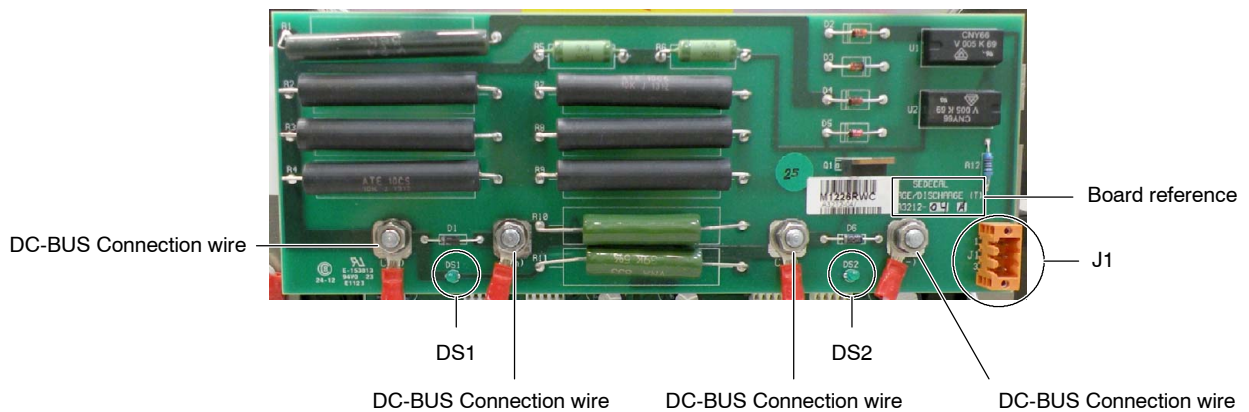
6. Secure the new Storage Capacitor to the module by securing the Tie wrap.
7. Reinstall the Inverter Module as described in Job Card 1.1 from step 14. to the end of the process.
8. Note in the Data Book the cause and date of the replacement in order to provide the maximum information.

JOB CARD 1.5: REPLACEMENT OF THE CHARGE/DISCHARGE BOARD

SUBASSEMBLY: CHARGE/DISCHARGE BOARD (A3212-XX).

TOOLS: Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.

PROCEDURE



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 ARE OFF, APPROXIMATELY 3 MINUTES AFTER THE UNIT IS TURNED OFF. CHECK THAT THE MEASURED VOLTAGE BETWEEN POSITIVE AND NEGATIVE DC VOLTAGE WIRES ON THE CHARGE/DISCHARGE BOARD IS < 10 V^{DC}.



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

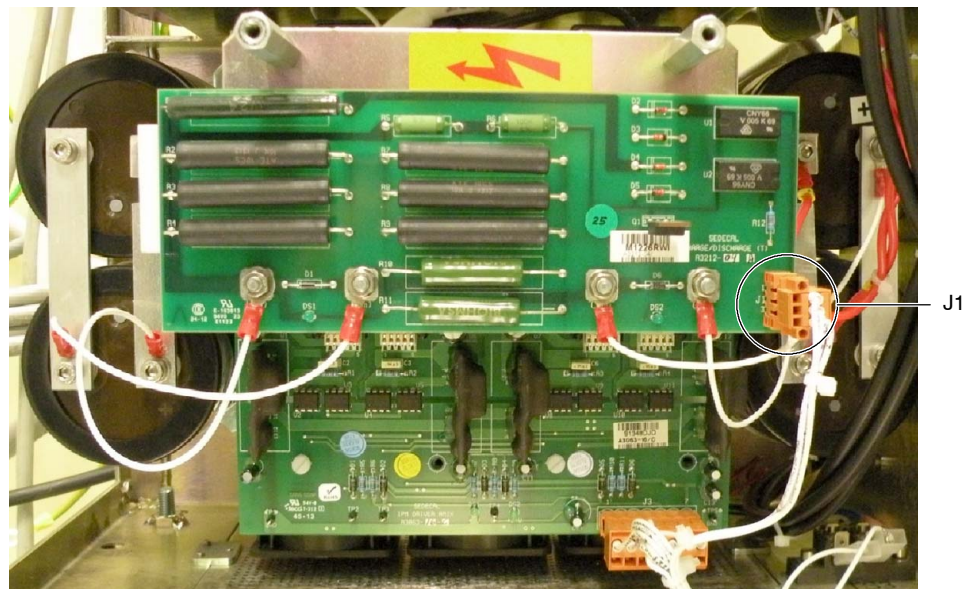
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ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.



Use the Anti-static Protection Device for handling or replacing any board or electronic part.

1. Remove the Generator Cover.
2. Remove the Allen screw that secure the Front Panel to the Generator Frame and open the Front Panel.
3. Remove the Protective Plastic Safety Cover from the front of the Inverter Module.
4. Remove the connector from J1 on the board.



5. Label and remove the DC-BUS wires (+) and (-) connected to the board and note their position.
6. The board is secured to the Inverter module with the nuts that fix the DC-BUS wires. Once they are removed, the Charge/Discharge board can be removed.
7. Replace the old board with the new one.
8. Reinstall the DC-BUS wires (+) and (-) with the previously removed nuts.
9. Connect the previously removed connector to J1.



MAKE SURE THAT THE DC-BUS WIRES (+) AND (-) ARE CONNECTED IN THE CORRECT SCREWS AND SECURED.

10. Turn the Generator ON.
11. Check for correct operation that:
 - a. LED DS1 is ON.
 - b. Measure the voltage in Resistor R4. It must be 0 V^{DC} when the equipment is ON. This should be more than 200 V^{DC} right after the equipment is Powered OFF.
 - c. Turn the Generator OFF and wait three (3) minutes for the Main Storage Capacitors to discharge.



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

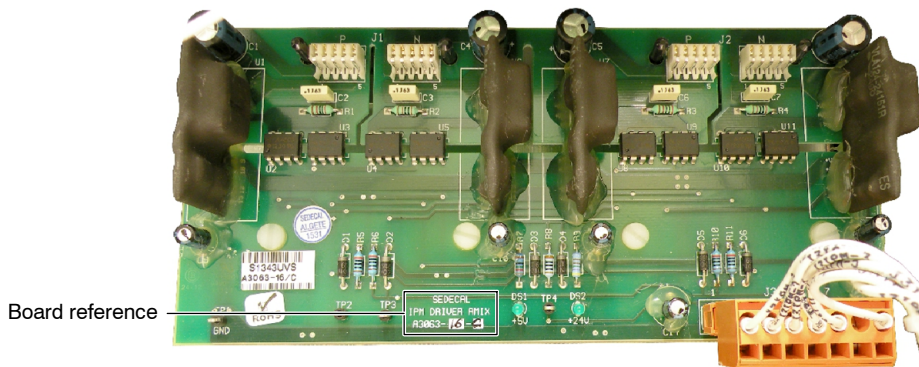
- d. LED DS1 is OFF.
 - e. Measure the voltage in Resistor R4, it must be 0 V^{DC} or close to 0 V^{DC} (less than 10 V^{DC}).
 - f. Measure the voltage at DC-BUS, it must be 0 V^{DC} or close to 0 V^{DC} (less than 10 V^{DC}).
12. Make a functional check of the equipment.
13. Note in the Data Book the cause and date of the replacement and fix an adhesive label beside the new board indicating the date and name of field engineer in order to provide the maximum information.
14. Reinstall the Protective Plastic Safety Cover at the front of the Inverter Module.
15. Close the Front Panel and secure it to the Generator Frame.
16. Reinstall the Generator Cover.

JOB CARD 1.6: REPLACEMENT OF THE IPM DRIVER BOARD

SUBASSEMBLY: IPM DRIVER BOARD (A3063-XX).

TOOLS: Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.

PROCEDURE



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 ARE OFF, APPROXIMATELY 3 MINUTES AFTER THE UNIT IS TURNED OFF. CHECK THAT THE MEASURED VOLTAGE BETWEEN POSITIVE AND NEGATIVE DC VOLTAGE WIRES ON THE CHARGE/DISCHARGE BOARD IS < 10 V_{DC}.



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

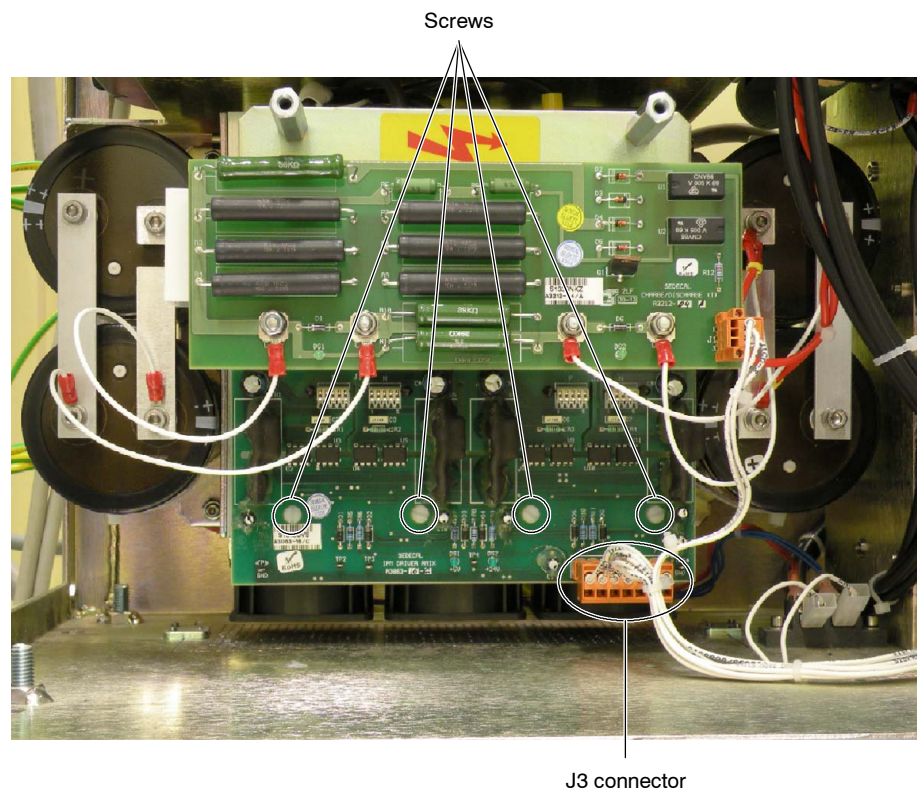
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ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.



Use the Anti-static Protection Device for handling or replacing any board or electronic part.

1. After accessing the Front Panel, remove the Plastic Safety Cover from the Inverter Module.
2. Disconnect the J3 connector from the board and remove the four screws used to fix the IPM Driver board to the Inverter Module (*refer to the illustration below*).



The pins connected on the back side of the IPM Driver board are fragile, take care when removing it and installing the replacement board.

3. Remove the IPM Driver board by pulling it gently and perpendicular from the Module.
4. When installing the replacement IPM Driver board, ensure that the pins on the IGBTs line up with the connectors on the board.
5. Replace the four screws.
6. Plug the J3 connector.
7. Power ON the Electrical Cabinet and then the System.
8. Check for a correct operation.
9. Make a functional check of the equipment.
10. Note in the Data Book the cause and date of the replacement and fix an adhesive label of the new board indicating the date and name of the field engineer in order to provide the maximum information.

JOB CARD 1.7: REPLACEMENT OF THE IGBT**SUBASSEMBLY:** IGBTs IN THE INVERTER MODULE.**TOOLS:** Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.**PROCEDURE**

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 ARE OFF, APPROXIMATELY 3 MINUTES AFTER THE UNIT IS TURNED OFF. CHECK THAT THE MEASURED VOLTAGE BETWEEN POSITIVE AND NEGATIVE DC VOLTAGE WIRES ON THE CHARGE/DISCHARGE BOARD IS < 10 V^{DC}.



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

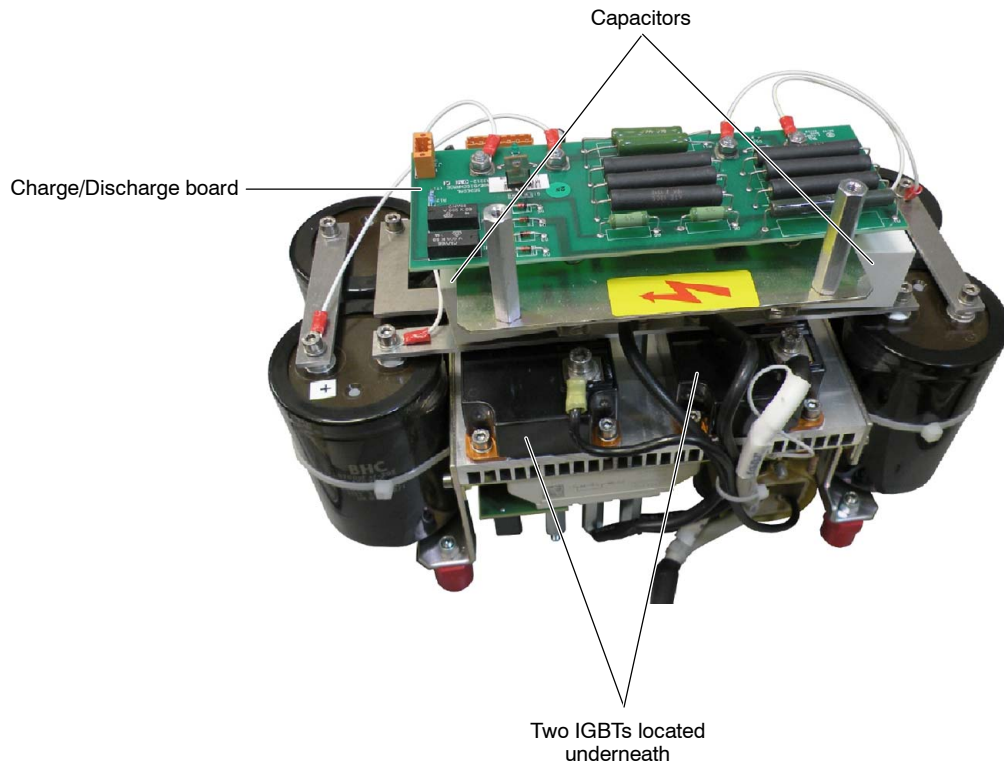
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ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.



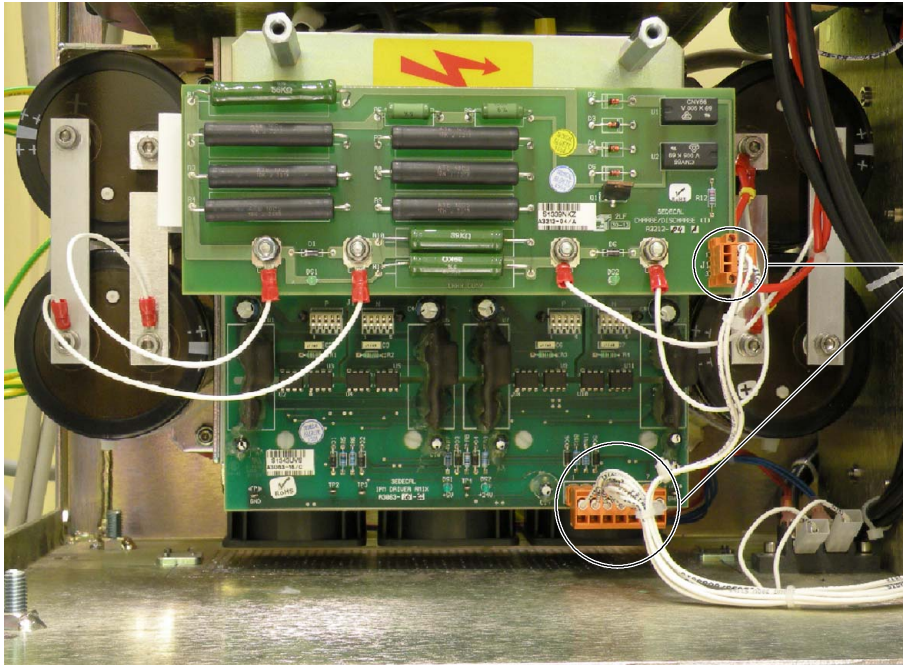
Use the Anti-static Protection Device for handling or replacing any board or electronic part.

Both IGBTs are located at the middle of the Inverter Module (behind the Charge/Discharge and IPM Driver boards and the two capacitors).



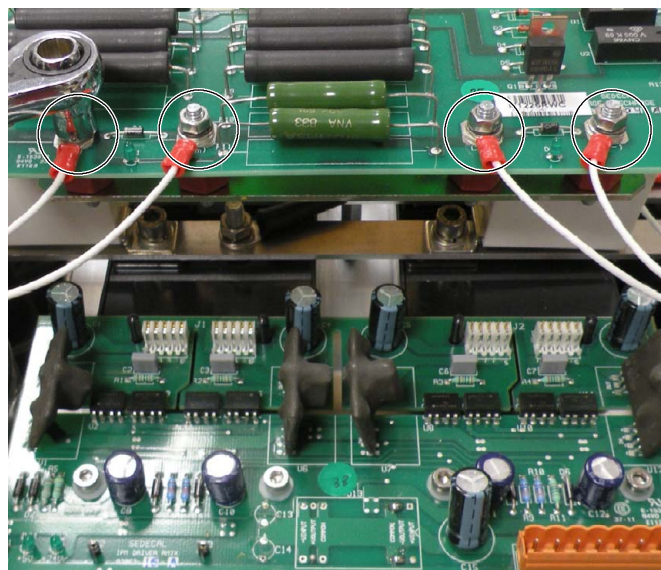
1. Remove the Generator Cover.
2. Remove the Allen screw that secure the Front Panel to the Generator Frame and open the Front Panel.
3. Remove the Protective Plastic Safety Cover from the front of the Inverter Module.

4. Disconnect the Cables from the IPM Driver and Charge/Discharge boards.

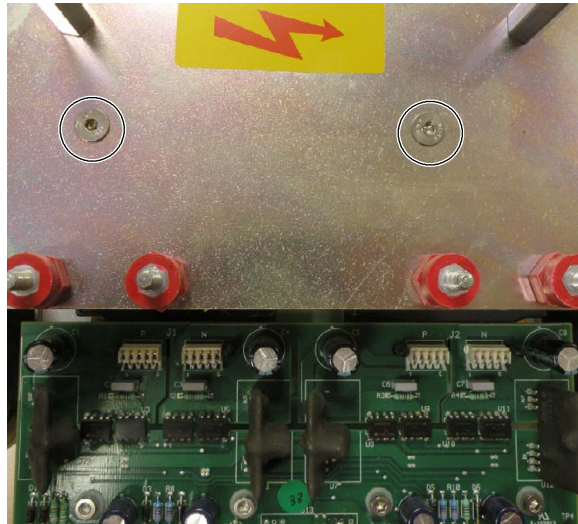


Disconnect both cables

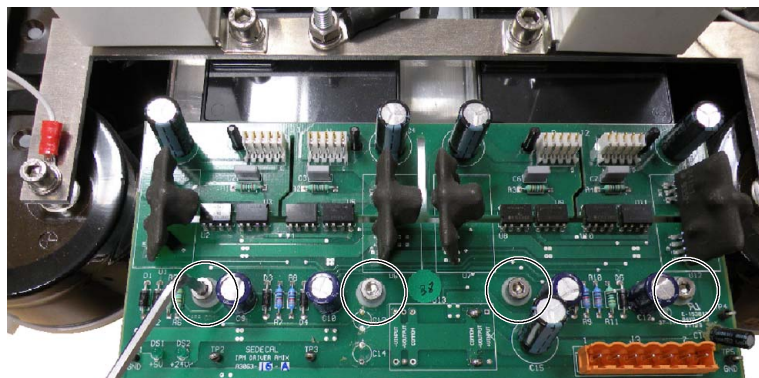
5. Label and disconnect the DC-BUS wires from the Charge/Discharge board, secured with round terminals to the Main Storage Capacitors. Take note of the wires position and mark the respective wire if necessary. The nuts that hold these wires to the board also support the board, hold the Charge/Discharge board when unscrewing the nuts to avoid dropping it and remove it.



6. Unscrew the two allen screws that support the metal plate behind the Charge/Discharge board and remove it.



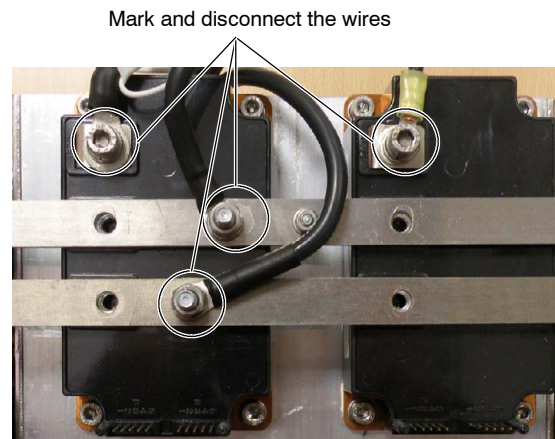
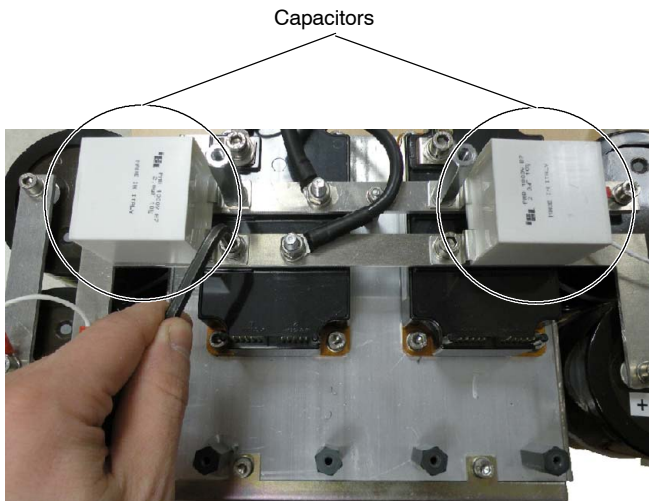
7. Remove the four screws used to fix the IPM Driver board to the Inverter Module.



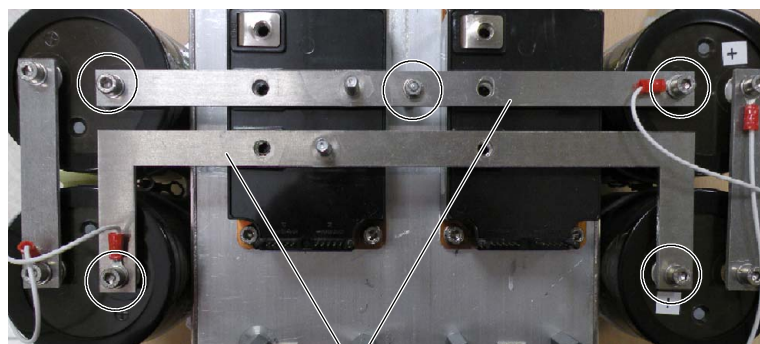
The IGBTs Connector Pins inserted on the back side of the IPM Driver board are fragile. Be careful when removing the board.

8. Remove the IPM Driver board by pulling it gently and perpendicular from the Module.

9. Remove the Allen screws and the standoffs (hexagonal spacers) that secure the two Capacitors (2 Micro/1000 V) on the DC-BUS. Then remove the two Capacitors and the wires connected to the DC-BUS and to the IGBTs. Take note of the wires position and mark the respective wire if necessary.



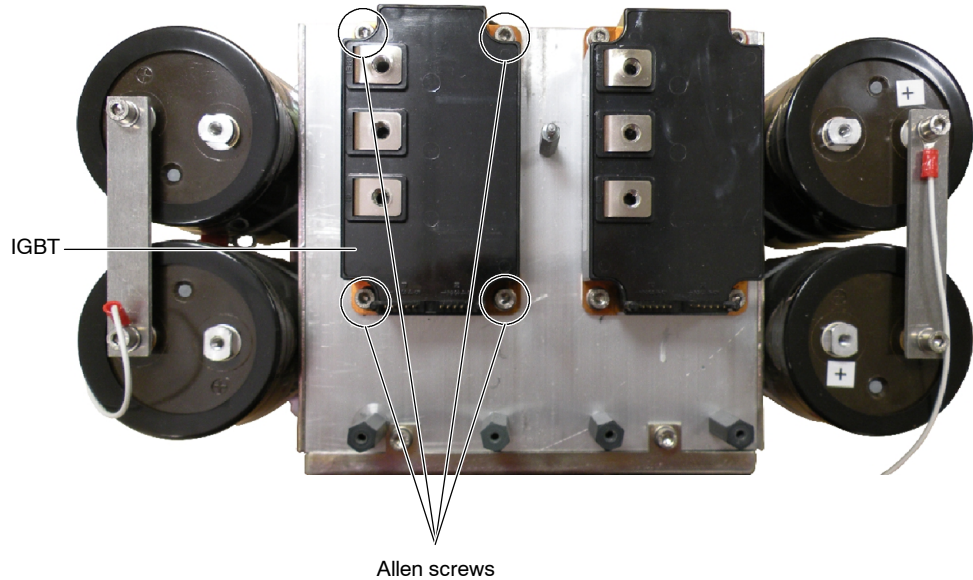
10. Label and disconnect the wires from the DC-BUS and remove the rest of the screws and the DC-BUS (metallic rails) over both IGBTs.



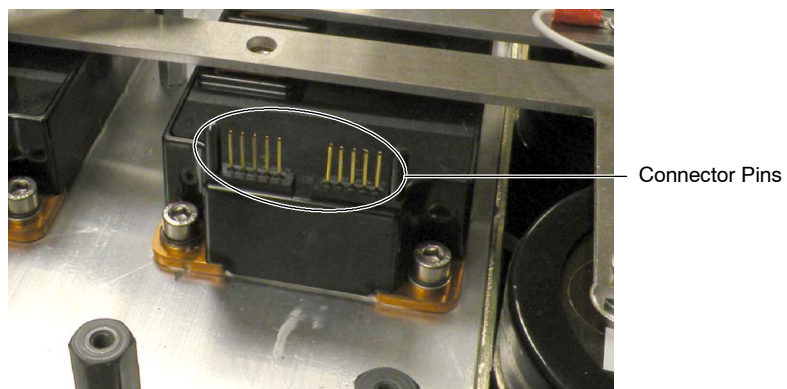
DC-BUS

11. Remove the screws that fix the IGBT to the Heat Sink and take note of the IGBT position.

12. Install the new IGBT keeping a thin layer of semiconductor silicone paste between the IGBT and the Heat Sink. Secure the IGBT to the Heat Sink with the removed Allen Screws.

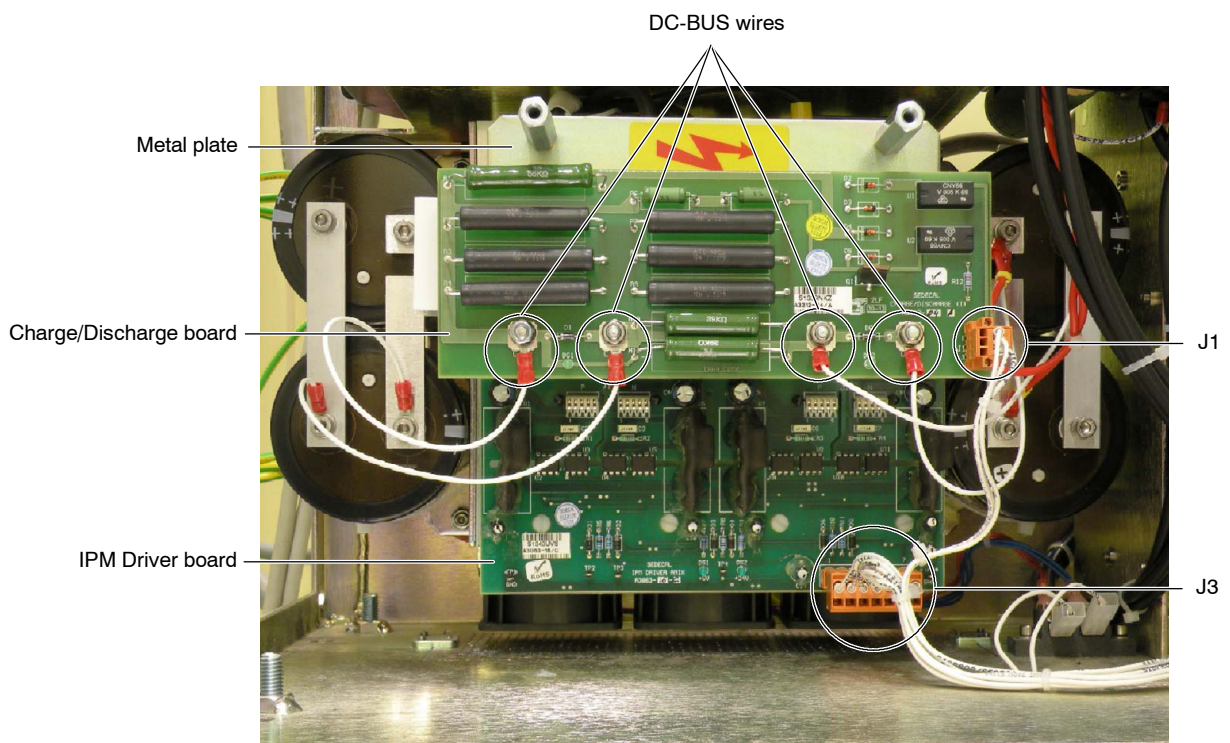


13. Reinstall the DC-BUS (metallic rail) over both IGBTs and connect the previously disconnected wires from the DC-BUS.
14. Reinstall the two Capacitors (2 Micro/1000 V) on the DC-BUS and the wires previously disconnected from the DC-BUS and from the IGBTs.
15. Reinstall the IPM Driver board. Ensure that the IGBTs Connector Pins line up with the connectors on the board.



The IGBTs Connector Pins inserted on the back side of the IPM Driver board are fragile. Be careful when installing the board.

16. Secure the IPM Driver board with the four screws.
17. Reinstall the metal plate and the Charge/Discharge board on it.
18. Reconnect the DC-BUS wires to the Charge/Discharge board and fix it with the previously removed nuts.
19. Reconnect the Cables to the IPM Driver (J3) and Charge/Discharge (J1) boards.



20. Reinstall the Protective Plastic Safety Cover at the front of the Inverter Module.
21. Close the Generator Front Panel and reinstall the Allen screw that secure the Front Panel to the Generator Frame.
22. Reinstall the Generator Cover.
23. Note in the Data Book the cause and date of the replacement in order to provide the maximum information.

JOB CARD 2.1: REPLACEMENT OF THE HIGH VOLTAGE TANK

SUBASSEMBLY: **HIGH VOLTAGE TANK.**

TOOLS: Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.

PROCEDURE



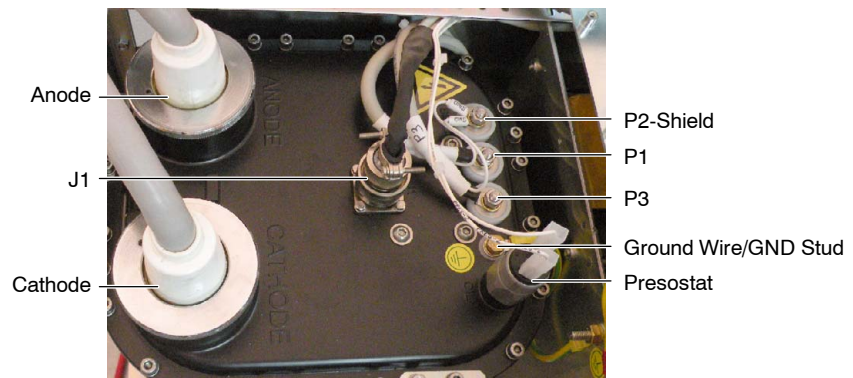
BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

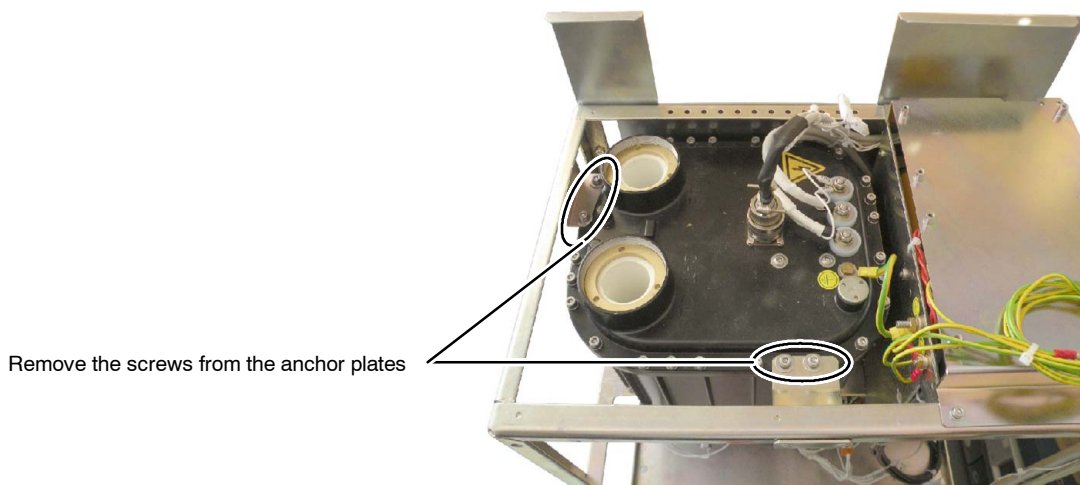
1. First of all, make sure that the Input line is disconnected and the Capacitor bank is properly discharged. Then, disconnect the anode and cathode cables and the following cables from the corresponding terminals on the HV Transformer:
 - P2-Shield, P1 and P3.
 - Ground wire from Ground stud.
 - Connector J1.
 - Presostat.

Illustration 5-1
Cable Connections to the HV Transformer



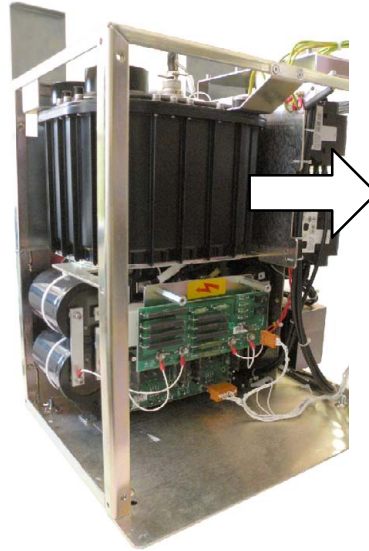
2. Next, unscrew the HV Transformer from its respective anchor plates.

Illustration 5-2
Anchor plates



- Carefully, take out the HV Transformer from the Generator cabinet and put it aside.

Illustration 5-3
HV transformer removal



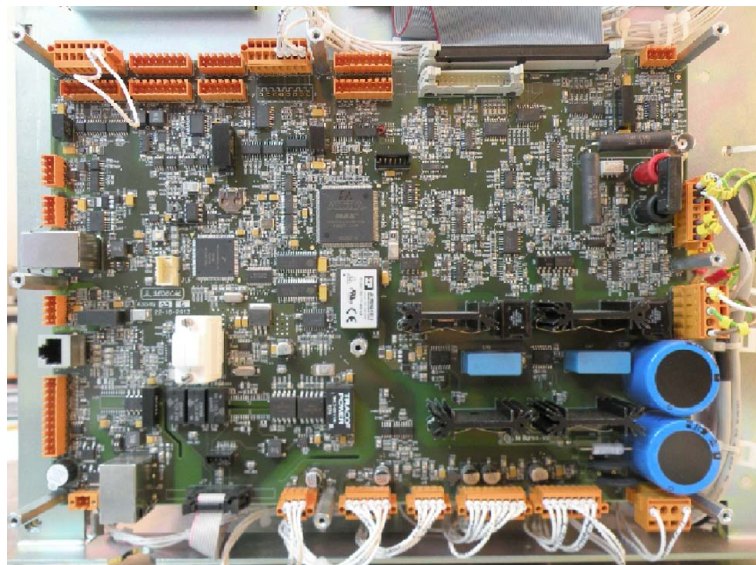
- Install the new HV Transformer inside the Cabinet and secure it with the respective anchor plates. Then, connect the previously removed cables to the corresponding terminals on the HV Transformer.
- When connecting the P2-Shield (2 thin wires), P1 and P3 cables to the stud-brass terminals, use two wrenches to tighten the nuts (one to hold the base nut in place and the other to tighten the nut over the cable) and to avoid twisting the studs. Ensure that the connection is secure and properly tightened.



WARNING

THE HV TRANSFORMER HAS TO BE SECURED WITH ITS ANCHOR PLATES INSIDE THE CABINET. OTHERWISE P1, P2 AND P3 STUDS MAY BE IN CONTACT WITH THE CABINET FRAME AND PRODUCE A SHORT-CIRCUIT.

- Perform the Gains adjustment before calibrating the equipment (*refer to the "Gains adjustment" Section on the Calibration document*).
- Calibrate the Filament Current data (*refer to the "Autocalibration" Section on the Calibration document*).
- Perform the Fall Time adjustment (*refer to the "Fall Time adjustment" Section on the Calibration document*).
- Perform the Fluoro calibration (if needed).

JOB CARD 3.1: REPLACEMENT OF THE CONTROL BOARD**SUBASSEMBLY:** CONTROL BOARD (A3640-XX)**TOOLS:** Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.**PROCEDURE**

BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

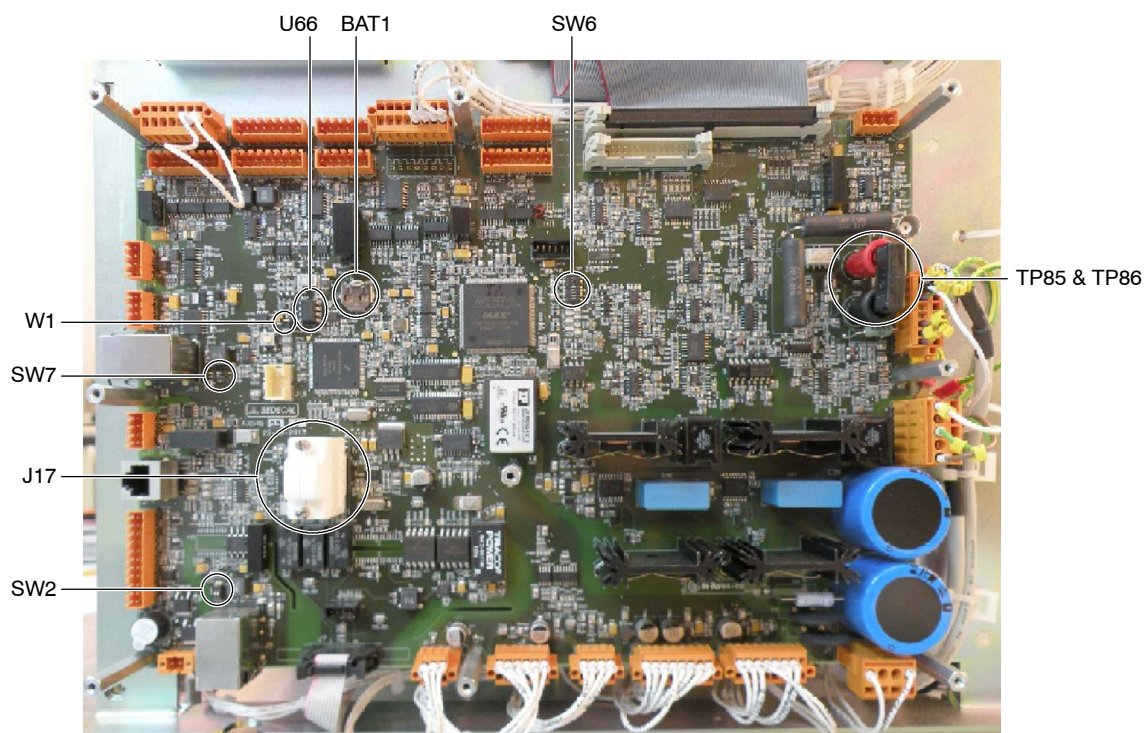
ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

1. Before removing the A3640-XX Control board, make sure to have a backup copy of the Configuration file and, in case of using AEC, of the Calibration file as well. Otherwise, save a backup of the needed data in the computer, if possible (*refer to the Configuration and Calibration documents*). Then, turn off the Generator and power off the Electrical Room Cabinet before proceeding with the next steps.

2. Remove the protective Plastic Safety Cover from the A3640-XX Control board.
3. Mark and unplug all the connectors from the board and remove the Licence from J17.
4. Remove the hexagonal spacers taking care the A3640-XX Control board does not fall.
5. Remove the A3640-XX Control board and put it aside.
6. Mount the new A3640-XX Control board with the previously removed hexagonal spacers.
7. Plug the previously removed connectors and the Licence (J17) and check that the battery is correctly installed in the new board.
8. Check that jumpers in W1 and between TP85 and TP86 are installed.
9. Check that SW2, SW6 and SW7 switches are set as in the previously removed board.

Illustration 5-4

Control board switches, jumpers, battery, Licence and EEPROM location



10. Turn on the Generator and open the Service Console program.

11. Update the software version if necessary (*refer to Section 2.2*).
12. Set the configuration parameters as per the customer's request. To do so:
 - Restore the Configuration data from the backup file saved in the computer (*refer to the Configuration document*).
 - If there is no backup file or it can not be restored, make a backup copy of the mA gains values of the new board (*refer to the Calibration document*). Then, transfer the U66-EEPROM from the old board to the new one and restore the mA gains values from the backup file saved before (*refer to the Calibration document*).
 - If the backup file can not be restored and the U66-EEPROM is defective, set the configuration parameters as needed by the customer (*refer to the Configuration document*).
13. Adjust time and date (*refer to the Configuration document*).
14. Download the Tube or the list of tubes to be used (*refer to the Configuration document*).
15. Reboot the Generator to apply the changes.
16. Reset the Tube counters and clear the Error log (*refer to the Configuration document*).
17. Perform the kVp Oscillator adjustment (*refer to the Calibration document*).
18. Calibrate the lowest mA station with 80 kVp for Large Focal Spot. If the lowest mA station of the Generator is not available for Large Focal Spot, calibrate it for Small Focal Spot (*refer to the "Manual Calibration" section on the Calibration document*).



PERMANENT DAMAGE CAN BE CAUSED TO THE TUBE IF THE REQUIRED MA STATION IS NOT ACCURATELY CALIBRATED BEFORE PERFORMING THE KVP GAIN ADJUSTMENT.

19. Adjust the kVp gain (*refer to the Calibration document*).
20. Perform the Autocalibration of the Filament Current data (*refer to the Calibration document*).

Note 

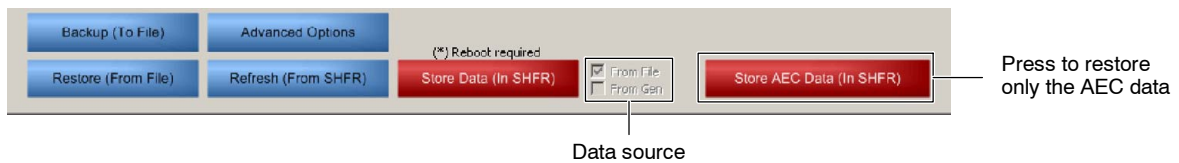
Take into account that if the Filament Current data backup file is restored instead of performing the whole Autocalibration procedure, Filament Current will not be as accurate as it should.

21. Perform the Fall Time adjustment (*refer to the Calibration document*). Make sure to save the new value by pressing the “Store Data (In SHFR)” button of the Parameters Calibration screen before proceeding with the next steps.
22. Restore the AEC data, if necessary. To do so, enter in the Parameters Calibration screen of the Service Console, press on the “Restore (From File)” button and select the backup file saved in the computer. All the calibration data of the file will be shown on screen. Then, press **only** on the “Store AEC Data (In SHFR)” button to restore the AEC data, keeping the rest of the data as it was. If the backup file can not be restored, calibrate the AEC (*refer to the Calibration document*).

Note 

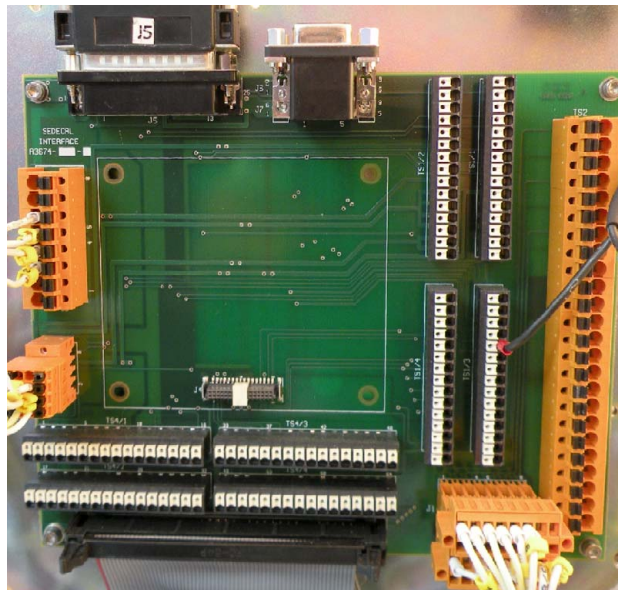
Take into account that after pressing the “Restore (From File)” button, the data shown on screen is not saved to the Generator yet.

Illustration 5-5
AEC data storage



When restoring the AEC data, take care not to press on the “Store Data (In SHFR)” button. Otherwise, Gains, Fluoro and Digital potentiometers data will be replaced by the data of the previous board.

23. Calibrate Fluoro and ABC, if necessary (*refer to the Calibration document*).
24. Write the Generator Serial number by double-clicking on it on the Service Console program. A password is required, use the password for advanced options (*refer to the Configuration document*).
25. Save a general backup in the computer (*refer to the Configuration document*).
26. Screw the protective Plastic Safety Cover to the hexagonal spacers.

JOB CARD 3.2: REPLACEMENT OF THE INTERFACE BOARD**SUBASSEMBLY: INTERFACE BOARD (A3674-XX)****TOOLS:** Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.**PROCEDURE**

BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

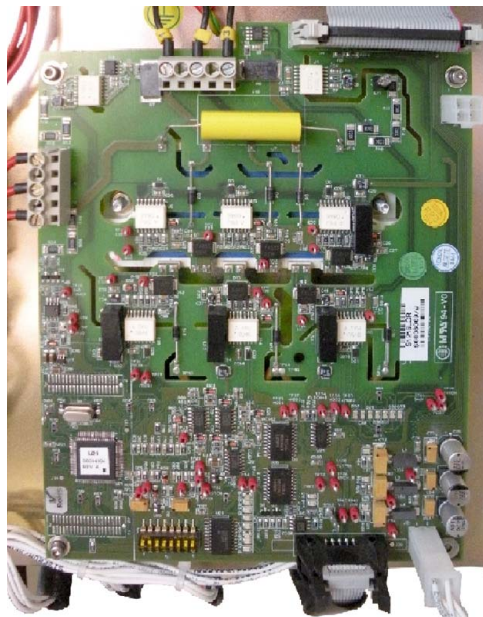
1. Mark and remove all the connectors and wires from the Interface board.
2. Unscrew the Interface board from the front panel and install the new one.
3. Connect all the previously removed connectors and wires in the same position.

JOB CARD 4.1: REPLACEMENT OF THE DUAL SPEED STARTER

SUBASSEMBLY: DUAL SPEED STARTER (S0008009)

TOOLS: Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.

PROCEDURE



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

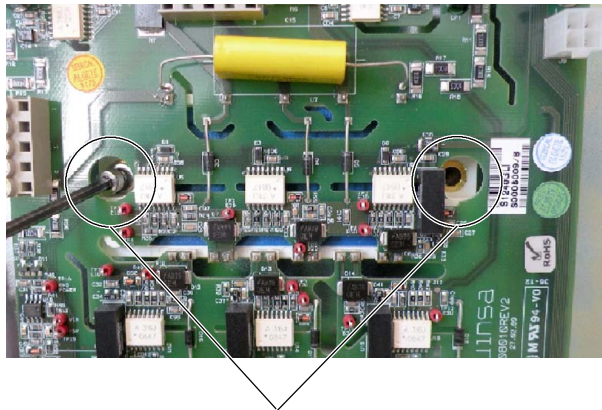
DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

1. Remove the protective Plastic Safety Cover from the Dual Speed Starter.
2. Mark and remove all the connectors and wires from the Dual Speed Starter.

3. Unscrew the Dual Speed Starter from the Back Panel by removing the hexagonal spacers and the two screws that hold the IGBT of the board to the Back Panel.

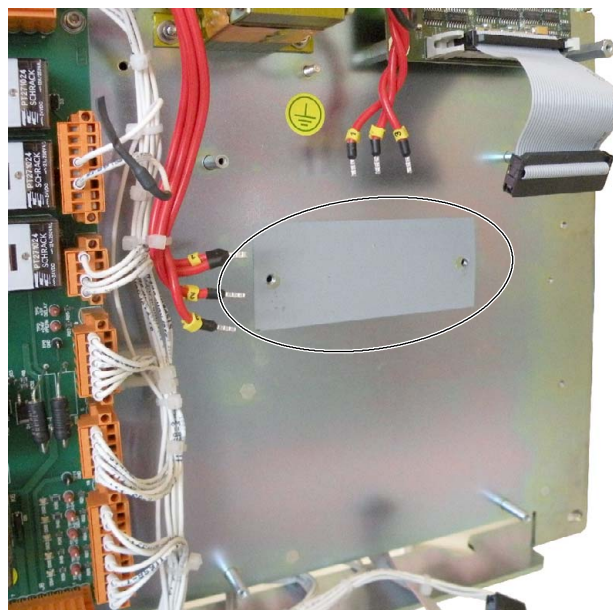
Illustration 5-6
IGBT screws



Unscrew before removing the board

4. Install the new Dual Speed Starter, screwing the four hexagonal spacers and the two screws of the IGBT to the Back Panel, making sure that the self-adhesive protector remains stuck to the back panel.

Illustration 5-7
Self-adhesive protector

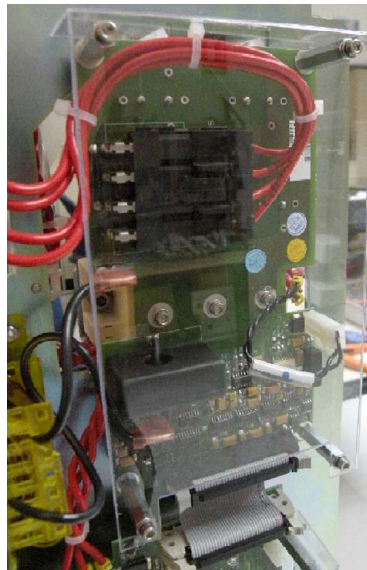


5. Check that switch S1-2 is set to ON and the remaining switches are set to OFF.

Illustration 5-8 Dual Speed Starter switches



6. Connect all the previously removed connectors and wires in the same position and screw the protective Plastic Safety Cover.

JOB CARD 4.2: REPLACEMENT OF THE BOOSTER MODULE**SUBASSEMBLY:** BOOSTER MODULE (S0008007)**TOOLS:** Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.**PROCEDURE**

BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

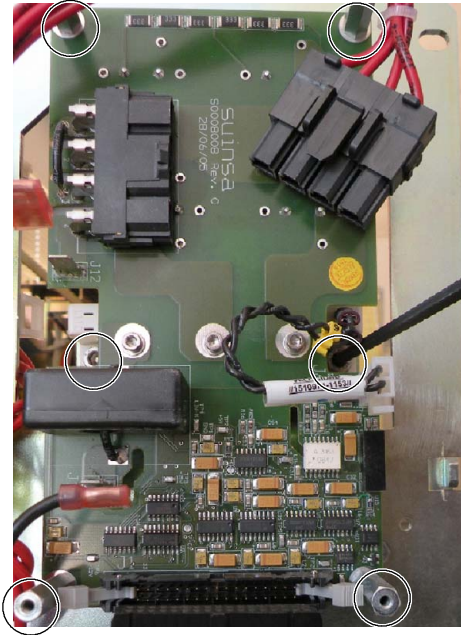
ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

1. Remove the protective Plastic Safety Cover from the Booster Module.
2. Mark and remove all the connectors and wires from the Booster Module.
3. Unscrew the IGBT from the Back Panel (two screws).

4. Unscrew the Booster Module from the Back Panel by removing the four hexagonal spacers.

Illustration 5-9

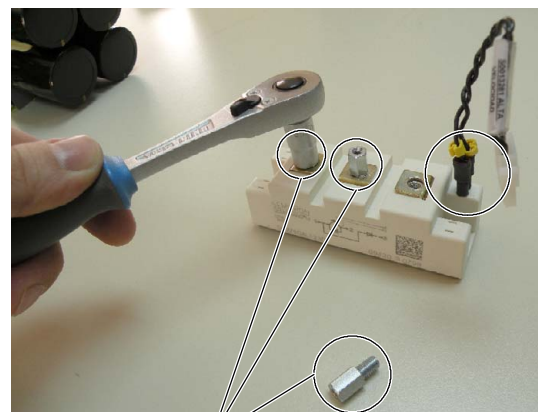
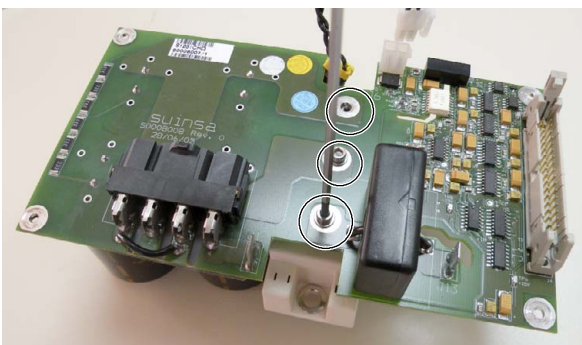
IGBT screws and hexagonal spacers



5. Unscrew the IGBT from the board and remove the three hexagonal spacers and the cable from the IGBT.

Illustration 5-10

IGBT spacers

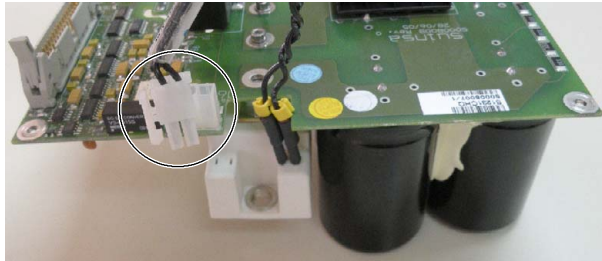


Hexagonal spacers

6. Install the cable in the new IGBT, taking care to plug the two wires in the same position as in the old IGBT.

7. Mount the previously removed spacers on the new IGBT and screw it to the new board. Connect the IGBT connector to J6 of the board.

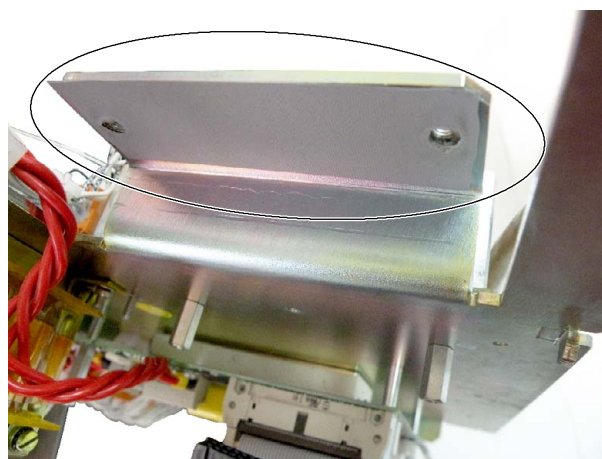
Illustration 5-11
J6 connector



IF THE TWO WIRES OF THE IGBT CABLE ARE NOT CONNECTED IN THE CORRECT POSITION IN THE IGBT AND/OR THE CABLE IS NOT CONNECTED TO J6 OF THE S0008007 BOOSTER MODULE BEFORE POWERING ON THE GENERATOR, PERMANENT DAMAGE WILL BE CAUSED TO THE EQUIPMENT.

8. Install the new Booster Module, screwing the four hexagonal spacers and the new IGBT to the Back Panel, making sure that the self-adhesive protector remains stuck to the back panel.

Illustration 5-12
Self-adhesive protector



9. Connect all the previously removed connectors and wires in the same position and screw the protective Plastic Safety Cover.

JOB CARD 4.3: REPLACEMENT OF THE BOOSTER IGBT

SUBASSEMBLY: BOOSTER IGBT (S0009814)

TOOLS: Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.

PROCEDURE



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

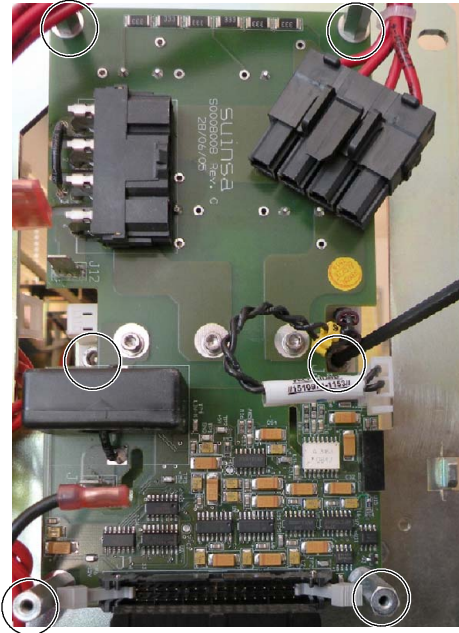
DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

1. Remove the protective Plastic Safety Cover from the Booster Module.
2. Mark and remove all the connectors and wires from the Booster Module.
3. Unscrew the IGBT from the Back Panel (two screws).

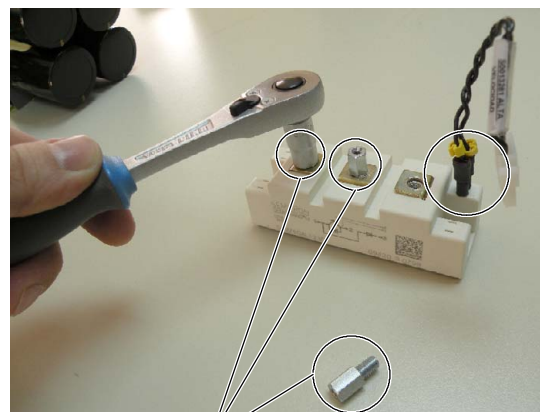
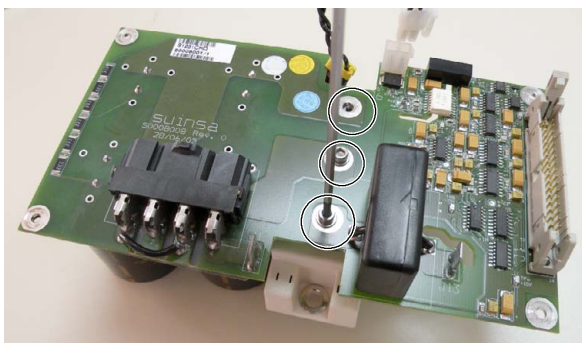
4. Unscrew the Booster Module from the Back Panel by removing the four hexagonal spacers.

Illustration 5-13
IGBT screws and hexagonal spacers



5. Unscrew the IGBT from the board and remove the three hexagonal spacers and the cable from the IGBT.

Illustration 5-14
IGBT spacers

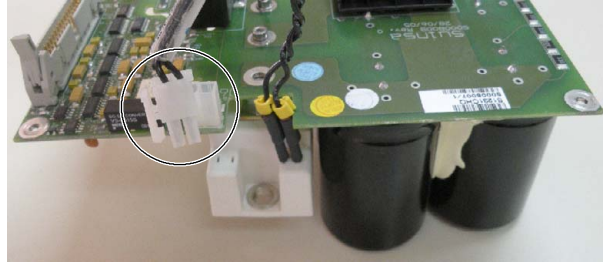


Hexagonal spacers

6. Install the cable in the new IGBT, taking care to plug the two wires in the same position as in the old IGBT.

7. Mount the previously removed spacers on the new IGBT and screw it to the board. Connect the IGBT connector to J6 of the board.

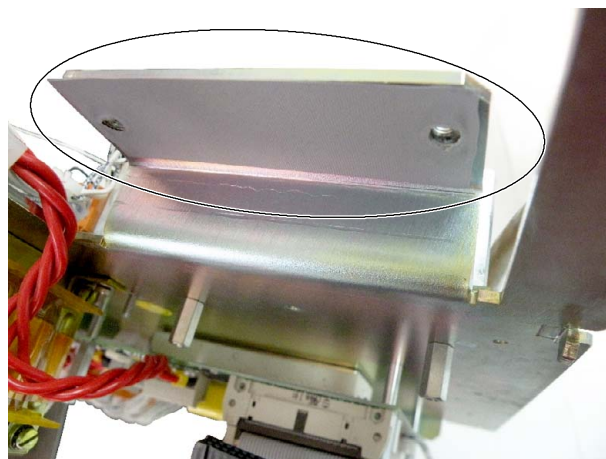
Illustration 5-15
J6 connector



IF THE TWO WIRES OF THE IGBT CABLE ARE NOT CONNECTED IN THE CORRECT POSITION IN THE IGBT AND/OR THE CABLE IS NOT CONNECTED TO J6 OF THE S0008007 BOOSTER MODULE BEFORE POWERING ON THE GENERATOR, PERMANENT DAMAGE WILL BE CAUSED TO THE EQUIPMENT.

8. Install the Booster Module, screwing the four hexagonal spacers and the new IGBT to the Back Panel, making sure that the self-adhesive protector remains stuck to the back panel.

Illustration 5-16
Self-adhesive protector



9. Connect all the previously removed connectors and wires in the same position and screw the protective Plastic Safety Cover.

JOB CARD 4.4: REPLACEMENT OF THE SUPPLY BOARD**SUBASSEMBLY:** SUPPLY BOARD (A3646-XX)**TOOLS:** Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.**PROCEDURE**

BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

1. Mark and remove all the connectors and wires from the Supply board.
2. Unscrew the Supply board from the Back Panel and install the new one.
3. Connect all the previously removed connectors and wires in the same position.

JOB CARD 4.5: REPLACEMENT OF THE POWER SUPPLY

SUBASSEMBLY: **POWER SUPPLY**

TOOLS: Standard Service Tool Kit, including Allen and Torx key sets, and Anti-static Protection Device.

PROCEDURE



BEFORE REPLACING THIS PART BE SURE THAT THE GENERATOR AND THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) ARE POWERED OFF.

DO NOT SUPPLY THE MAIN POWER FROM THE ELECTRICAL ROOM CABINET (MAIN DISCONNECT) OR TURN ON THE SYSTEM UNTIL SPECIFICALLY INSTRUCTED IN THIS DOCUMENT.

ALSO, FOLLOW THE GENERAL CAUTIONS INDICATED AT THE BEGINNING OF THIS DOCUMENT.

1. Unscrew and remove the covers from the Power supply.
2. Unplug both connectors from the Power supply.

3. Unscrew and remove the Power supply and replace it by the new one.

Illustration 5-17
Power supply without covers



4. Connect all the previously removed connectors in the same position.
5. Adjust the Power supply potentiometer (*refer to Section 2.3*).
6. Put the covers back.

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SECTION 6 CENTRAL LISTINGS

This section is a compilation of the main components (Test Points, Connectors, LEDs, Switches and Fuses) of the electronic boards of the equipment.

Each drawing is accompanied by several tables including the most used components of the respective board. To find any component press “Ctrl + F”, enter the component reference (e.g. TP2) and press “Enter”.

6.1 GENERATOR BOARDS

The following list includes the boards which contain components that may require access during service procedures:

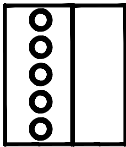
- IPM Driver board **A3063-XX** (page 215).
- Control board **A3640-XX** (page 217).
- Supply board **A3646-XX** (page 225).
- Hardware Bus - Ethernet CAN - SHFR Adaptation board **A9599-XX** (page 229).
- Booster Module **S0008007** (page 233).
- Dual Speed Starter **S0008009** (page 235).

Each board is represented by a layout followed by several tables with the most used Test Points, LEDs, Connectors, Pushbuttons, Switches and Jumpers.

Note 

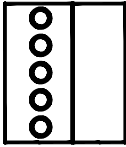
The Booster Module and the Hardware Bus - Ethernet CAN - SHFR Adaptation board may or may not be installed in the equipment, depending on the Generator configuration.

P

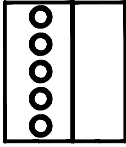


J1

N

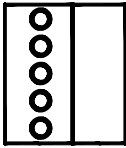


P



J2

N



J3



6.1.1 IPM DRIVER BOARD

Table 6-1
A3063-XX TP List

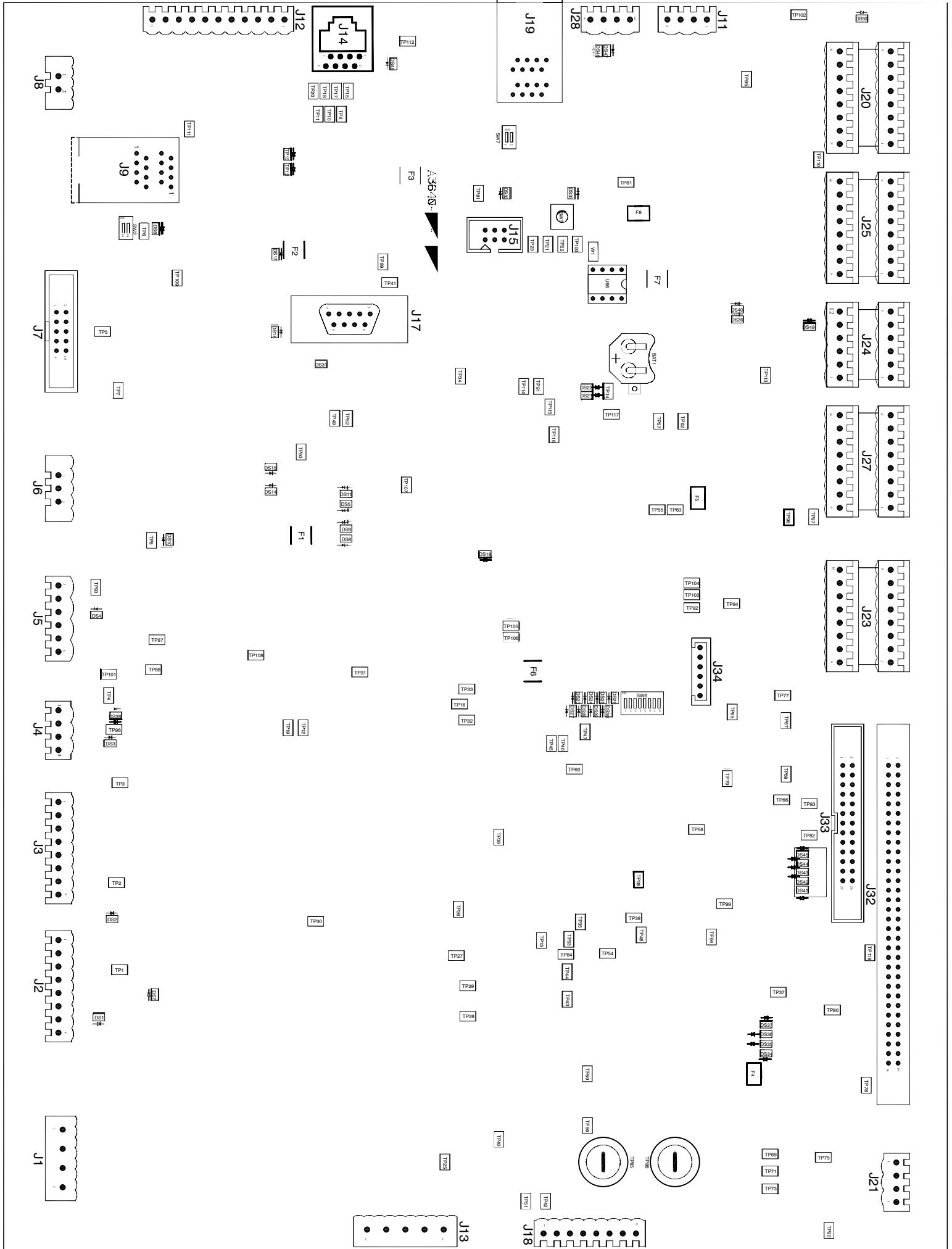
TEST POINTS	
TP	Measured signal
TP2	kV DR1
TP3	kV DR2
TP5	GND

Table 6-2
A3063-XX LEDs List

LEDs		
LED	Color	Measured signal
DS1	GREEN	+5V
DS2	GREEN	+24V

Table 6-3
A3063-XX Connectors List

CONNECTORS	
CONNECTOR	Description
J1	IPM1 CONNECTION
J2	IPM2 CONNECTION
J3	CONTROL BOARD



6.1.2 CONTROL BOARD

Note 

The following list includes the most used TP on the A3640-XX Control board. Some of the signals to be measured in the Control board are referenced to GND isolated from general ground, such as GND_P, GND_INT, GND_EXT and GND_SEC.

Table 6-4
A3640-XX TP List

TEST POINTS	
TP	Measured signal
TP1	-15V
TP2	+15V
TP3	+5V
TP4	GND
TP13	GND
TP14	GND
TP21	PREP
TP22	EXP
TP25	FIL CURR FG
TP26	FIL CURR FF
TP34	FLUORO SYNCHRONISM
TP35	SMALL FOCAL SPOT FILAMENT
TP36	LARGE FOCAL SPOT FILAMENT
TP37	kVp IMBALANCE
TP39	SMALL FOCAL SPOT FILAMENT INVERTER FREQUENCY
TP40	LARGE FOCAL SPOT FILAMENT INVERTER FREQUENCY
TP42	kV+
TP47	GND
TP48	Filtered mA
TP50	GND

**Table 6-4 (cont.)
A3640-XX TP List**

TP	Measured signal
TP51	kV-
TP54	Filtered kVp
TP56	mA+
TP57	kV DEMAND
TP59	mA-
TP60	kV INVERTER FREQUENCY
TP61	GND
TP64	GND
TP66	RAMP
TP67	UP PT
TP68	DWN PT
TP69	SCAN
TP77	ABC IN
TP81	GND
TP85	mAs
TP86	
TP92	ALOE/XOn
TP93	IGBT FAULT

Note 

Beside the most used test points, J12 connector on the A3640-XX Control board can also be useful for certain signals measurement: kVp, mA, Small and Large Focus Filaments, +24V, ±15V, +5V, Aloe and IGBT fault (refer to the Schematics document).

Table 6-5
A3640-XX LEDs List

LEDs		
LED	Color	Measured signal
DS1	GREEN	-15V
DS2	GREEN	+15V
DS3	GREEN	+5V
DS4	GREEN	+24V DELAYED
DS5	YELLOW	/LINE CONT
DS6	GREEN	+5V SEC1
DS7	GREEN	SUPPLY FIL
DS8	YELLOW	/BUCKY DR2
DS9	YELLOW	/BUCKY DR1
DS10	GREEN	+5V SEC
DS11	YELLOW	/CHRG DR
DS12	YELLOW	RXCAN0
DS13	YELLOW	TXCAN0
DS14	YELLOW	TXCAN1
DS15	YELLOW	RXCAN1
DS16	RED	/ROT FAULT
DS17	YELLOW	/RST
DS18	YELLOW	/C FLUORO ORDER +
DS21	YELLOW	μ PROCESSOR
DS22	RED	ALARM
DS23	YELLOW	/ERROR LED1
DS24	YELLOW	/ERROR LED3
DS25	YELLOW	/ERROR LED5
DS26	YELLOW	/ERROR LED7
DS27	RED	/ERROR LED0
DS28	YELLOW	/ERROR LED2
DS29	YELLOW	/ERROR LED4
DS30	YELLOW	/ERROR LED6

HF Series Generators

Central Listings

**Table 6-5 (cont.)
A3640-XX LEDs List**

LED	Color	Measured signal
DS31	YELLOW	BACKUP TIMER STATUS
DS32	YELLOW	TXCAN2
DS33	YELLOW	RXCAN2
DS34	YELLOW	/PREP
DS35	YELLOW	/EXP
DS36	YELLOW	/ALOE
DS37	YELLOW	/READY
DS38	GREEN	+24V UNR
DS39	YELLOW	RS232 RXD
DS40	YELLOW	RS232 TXD
DS41	YELLOW	START DR1
DS42	YELLOW	START DR2
DS43	YELLOW	FLD3 CAM1
DS44	YELLOW	FLD2 CAM1
DS45	YELLOW	FLD1 CAM1
DS46	YELLOW	RXD0
DS47	YELLOW	TXD0
DS49	GREEN	+5V ISO2
DS50	GREEN	+15V PERM ISO

**Table 6-6
A3640-XX Connectors List**

CONNECTORS	
CONNECTOR	Description
J1	FILAMENT SUPPLY IN
J2	SUPPLY
J3	POWER IN
J4	CONTACTOR
J5	IPM DRIVER

**Table 6-6 (cont.)
A3640-XX Connectors List**

CONNECTOR	Description
J6	CHARGE/DISCHARGE
J7	DUAL SPEED STARTER
J8	BUZZER
J9	CAN
J11	SPARE IN
J12	SUPERVISION
J13	FIL POWER
J14	HSW
J15	BDM
J17	LICENSE
J18	HV TRF
J19	CAN
J20	GP INP0
J21	ANALOG
J23A	BATTERY MONITOR
J23B	FLUORO/DSI
J24A	OUT1
J24B	OUT2
J25A	CONSOLA
J25B	RS422/485
J27	INTERLOCKS
J28	DOSE
J30	SCOPE PROBE
J32	INTERFACE BOARD
J33	GENERATOR J5 CONNECTOR
J34	AMP

Table 6-7
A3640-XX Pushbuttons List

PUSHBUTTON SWITCHES	
SWITCH	Function
SW3	RESET

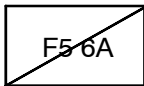
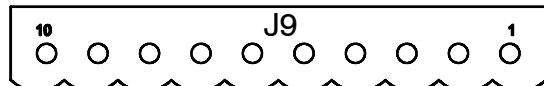
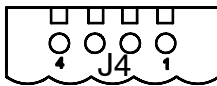
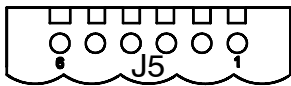
Table 6-8
A3640-XX Switches List

SWITCHES		
SWITCH		Function
SW2		NOT USED
SW6	1	NOT USED
	2	DISABLES HARDWARE ERRORS
	3	DEMO MODE (NO X-RAY)
	4	DISABLES THE FILAMENTS
	5	DISABLES DOSEMETER
	6	NOT USED
	7	NOT USED
	8	INITIALIZES THE EEPROM
SW7		NOT USED

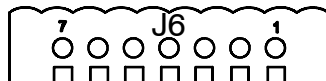
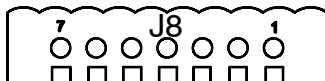
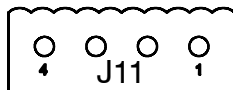
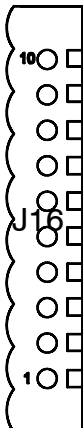
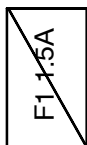
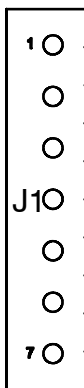
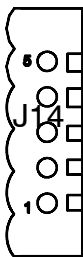
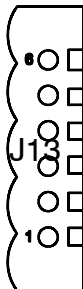
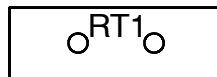
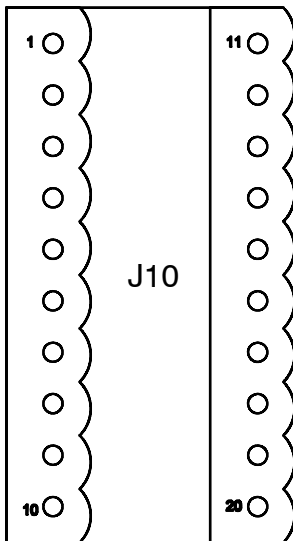
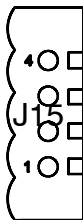
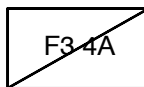
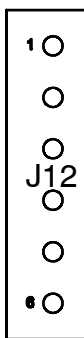
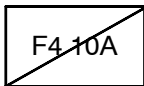
Table 6-9
A3640-XX Jumpers List

JUMPERS	
JUMPER	Function
W1	SOFTWARE UPDATE

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DS6



6.1.3 SUPPLY BOARD

Table 6-10
A3646-XX TP List

TEST POINTS	
TP	Measured signal
TP1	+24V
TP2	+24V VPERM
TP3	+24V DELAY
TP4	+5V
TP5	+5V DELAY
TP6	+15V
TP7	-15V
TP8	GND
TP11	GND

Table 6-11
A3646-XX LEDs List

LEDs		
LED	Color	Measured signal
DS1	GREEN	+24V PERM UNR
DS2	GREEN	+24V UNR
DS3	GREEN	+5V
DS4	GREEN	+15V
DS5	GREEN	-15V
DS6	GREEN	LOCK
DS7	GREEN	+5V DELAY
DS8	GREEN	+24V DELAY

HF Series Generators

Central Listings

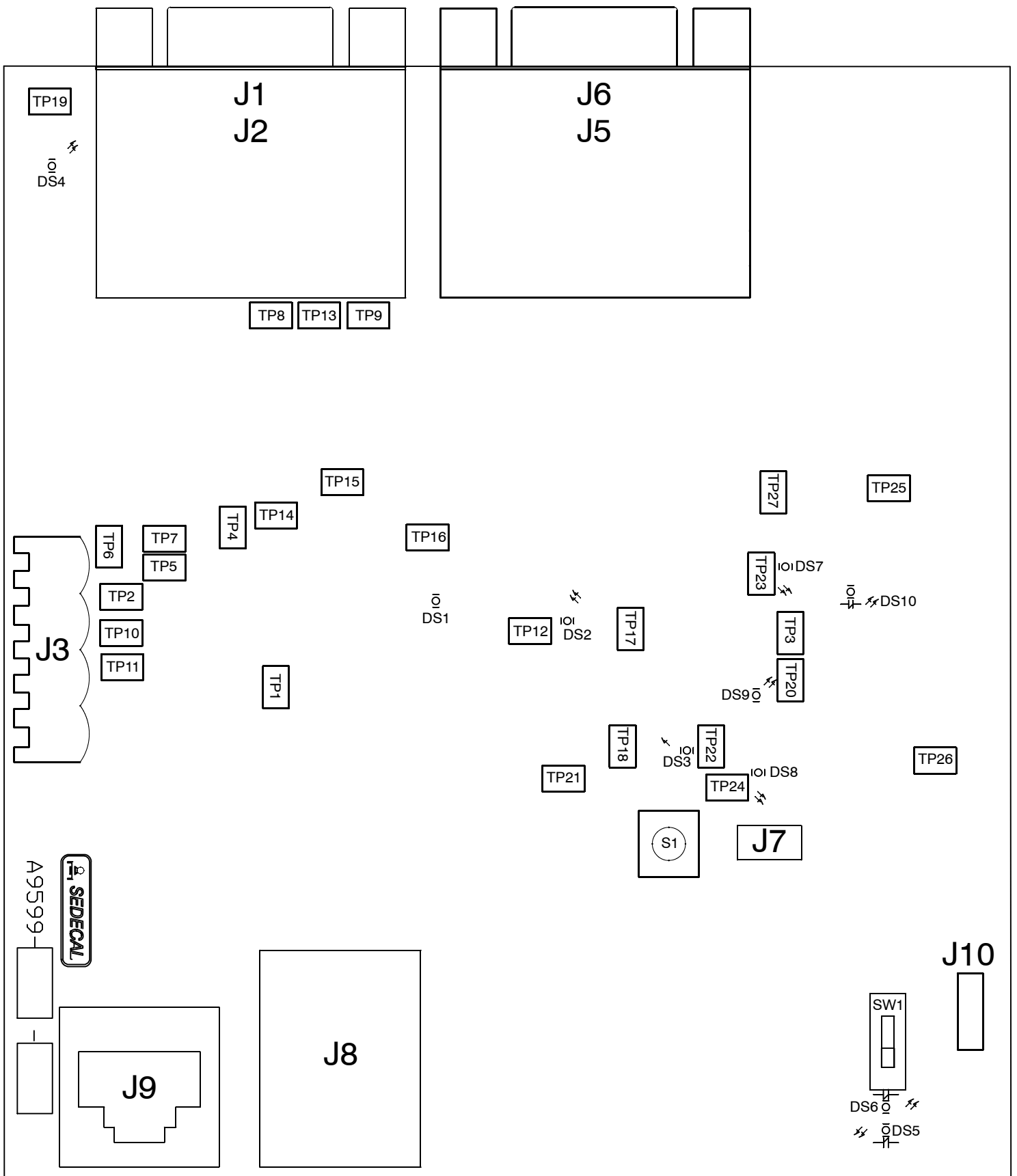
Table 6-12
A3646-XX Connectors List

CONNECTORS	
CONNECTOR	Description
J1	120/230 AC IN
J2	24 AC
J3	COLLIMATOR & LOCKS POWER IN
J4	LOCKS OUT
J5	COLLIMATOR
J6	PCB CONTROL SUPPLY
J7	ON/OFF
J8	CONTROL PCB
J9	ROOM LIGHT & DETECTORS CONTROL
J10	PS INTERFACE
J11	FILAMENT SUPPLY OUT
J12	RELAY K1
J13	RELAY K1
J14	DC POWER IN
J15	POWER DELAY
J16	GENERAL PURPOSE POWER

Table 6-13
A3646-XX Fuses List

FUSES	
FUSE	Description
F1	1.5A, 250V, SB
F2	3A, 250V, SB
F3	4A, 250V, SB
F4	10A, 250V, SB
F5	6.25A, 250V, SB

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6.1.4 HARDWARE BUS - ETHERNET-CAN

Table 6-14
A9599-XX TP List

TEST POINTS	
TP	Measured signal
TP1	GND SHFR
TP2	H. B. GND
TP3	GND SHFR
TP4	FLUORO ORDER
TP5	PREP ORDER
TP6	POS OK
TP7	EXP ORDER
TP8	EXP RQST
TP9	EX ON
TP10	DYN MODE1
TP11	DYN MODE2
TP12	GND 15V ISO
TP13	H. B. GND
TP14	SYNC FLUORO
TP15	SYNC RAD
TP16	5V DELAY
TP17	24V DELAY
TP18	15V ISO
TP19	H. B. 24V
TP20	GND 15V ISO
TP21	CLOCK BUFFER
TP22	3.3V
TP23	24V DET ISO
TP24	5V DET ISO
TP25	GND DET ISO
TP26	GND DET ISO
TP27	12V DET ISO

HF Series Generators

Central Listings

Table 6-15
A9599-XX LEDs List

LEDs		
LED	Color	Measured signal
DS1	GREEN	5V DELAY
DS2	GREEN	24V DELAY
DS3	GREEN	15V ISO
DS4	GREEN	H. B. 24V
DS5	RED	μC LED ERROR
DS6	YELLOW	μC LED STAT
DS7	GREEN	24V DET ISO
DS8	GREEN	5V DET ISO
DS9	GREEN	3.3V
DS10	GREEN	12V DET ISO

Table 6-16
A9599-XX Connectors List

CONNECTORS	
CONNECTOR	Description
J1	HARDWARE BUS
J2	HARDWARE BUS
J3	PSU / CONTROL BOARD
J4 (on the rear of the board)	INTERFACE BOARD
J5	DR1
J6	DR2
J7	JTAG
J8	ETHERNET
J9	CONTROL BOARD
J10	RS232

Table 6-17
A9599-XX Pushbuttons List

PUSHBUTTON SWITCHES	
SWITCH	Function
S1	μC RESET

Table 6-18
A9599-XX Switches List

SWITCHES	
SWITCH	Function
SW1	BOOTLOADER

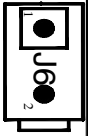
S0008007



J7

J12

U12



TP4
TP1
TP7

TP9

J13

TP8

J14

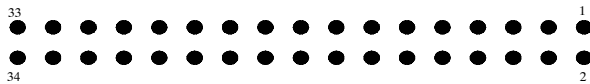
TP5

D1

TP3

TP6

J1



TP2

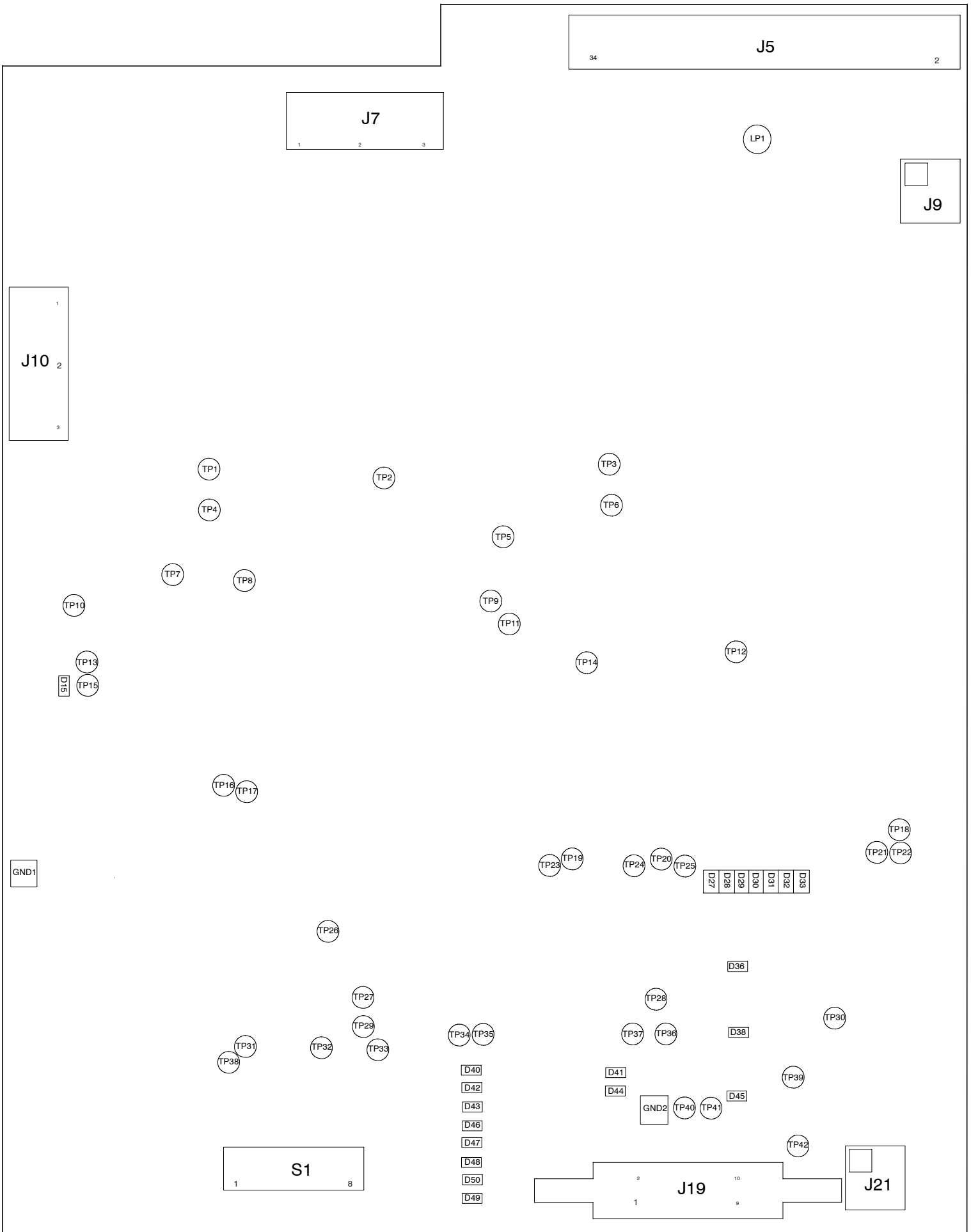
6.1.5 BOOSTER MODULE

Table 6-19
S0008007 TP List

TEST POINTS	
TP	Measured signal
TP6	+15V
TP7	+5V
TP8	-15V
TP9	+5V

Table 6-20
S0008007 Connectors List

CONNECTORS	
CONNECTOR	Description
J1	DUAL SPEED STARTER
J6	IGBT GATE
J7	DC BUS
J12	INDUCTANCE
J13	INDUCTANCE



6.1.6 DUAL SPEED STARTER

Table 6-21
S0008009 TP List

TEST POINTS	
TP	Measured signal
TP26	Vout
TP30	-15V
TP38	VAREF
TP39	+15V
TP41	+5V
TP42	+5V

Table 6-22
S0008009 LEDs List

LEDs		
LED	Color	Measured signal
D15	GREEN	-5V
D27	RED	/FLTINV
D28	RED	/FLTINV1
D29	RED	/FLTINV2
D30	RED	/FLTINV3
D31	RED	/FLTINV4
D32	RED	/FLTINV5
D33	RED	/FLTINV6
D36	GREEN	-15V
D38	GREEN	+15V
D40	RED	ERROR INDICATOR (Refer to Section 4.1 of the Troubleshooting document)
D41	YELLOW	RXD
D42	YELLOW	ERROR INDICATOR (Refer to Section 4.1 of the Troubleshooting document)

HF Series Generators

Central Listings

Table 6-22 (cont.)
S0008009 LEDs List

LED	Color	Measured signal
D43	YELLOW	ERROR INDICATOR (Refer to Section 4.1 of the Troubleshooting document)
D44	YELLOW	TXD
D45	GREEN	+5V
D46	YELLOW	ERROR INDICATOR (Refer to Section 4.1 of the Troubleshooting document)
D47	YELLOW	ERROR INDICATOR (Refer to Section 4.1 of the Troubleshooting document)
D48	YELLOW	ERROR INDICATOR (Refer to Section 4.1 of the Troubleshooting document)
D49	YELLOW	ERROR INDICATOR (Refer to Section 4.1 of the Troubleshooting document)
D50	YELLOW	ERROR INDICATOR (Refer to Section 4.1 of the Troubleshooting document)

Table 6-23
S0008009 Connectors List

CONNECTORS	
CONNECTOR	Description
J5	BOOSTER MODULE
J7	STATOR
J9	SUPPLY BOARD (N.U.)
J10	DC BUS
J19	CONTROL BOARD
J21	SUPPLY BOARD

Table 6-24
S0008009 Switches List

SWITCHES	
SWITCH	Function
S1	NOT USED